METHOW RIVER:

Alder Creek Floodplain Project

PERMIT LEVEL DESIGN

Yakama Nation Fisheries

TETRA TECH

MAY 2019

METHOW RIVER: TWISP TO CARLTON RESTORATION DESIGN, ALDER CREEK FLOODPLAIN PROJECT

PERMIT LEVEL DESIGN

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1. PREFACE

This report for the Methow River: Twisp to Carlton Restoration Design – Alder Creek Floodplain Project is based on the General Project Data Summary Requirements (GPDSR) Basis of Design Report template for Bonneville Power Administration (BPA) Habitat Improvement Program (HIP III) projects (BPA 2017). Some formatting changes have been made to the template but the sections and requested information follow the template structure.

The design process for the project as established by the Yakama Nation Fisheries includes the following steps and review junctures:

- Development of Concept-level Report and Drawings (Tetra Tech 2018)
- Development of Permit-level Report and Drawings (this submittal)
- Development of Final Construction Plans

1.1 Name and titles of sponsor, firms and individuals responsible for design

Project Name: Methow River Restoration Design – Alder Creek Floodplain Project

Project Location: Methow River, River Mile 33.8 to 34.4, Twisp, Washington (see Figure 1-1).

Sponsor: Yakama Nation Fisheries, 2 Johnson Lane, Winthrop, WA, 98862

Yakama Nation Fisheries Habitat Biologist: Madeleine Eckmann

Engineering firm: Tetra Tech, Inc. (Tetra Tech), 19803 North Creek Parkway, Bothell, WA 98011

Project Manager: Jonathan Thompson

Lead Design Engineer: Chad Bailey, PE, CFM

Supporting Engineers: Jeremy Andrews, PE and Chad McKinney, PE, CFM

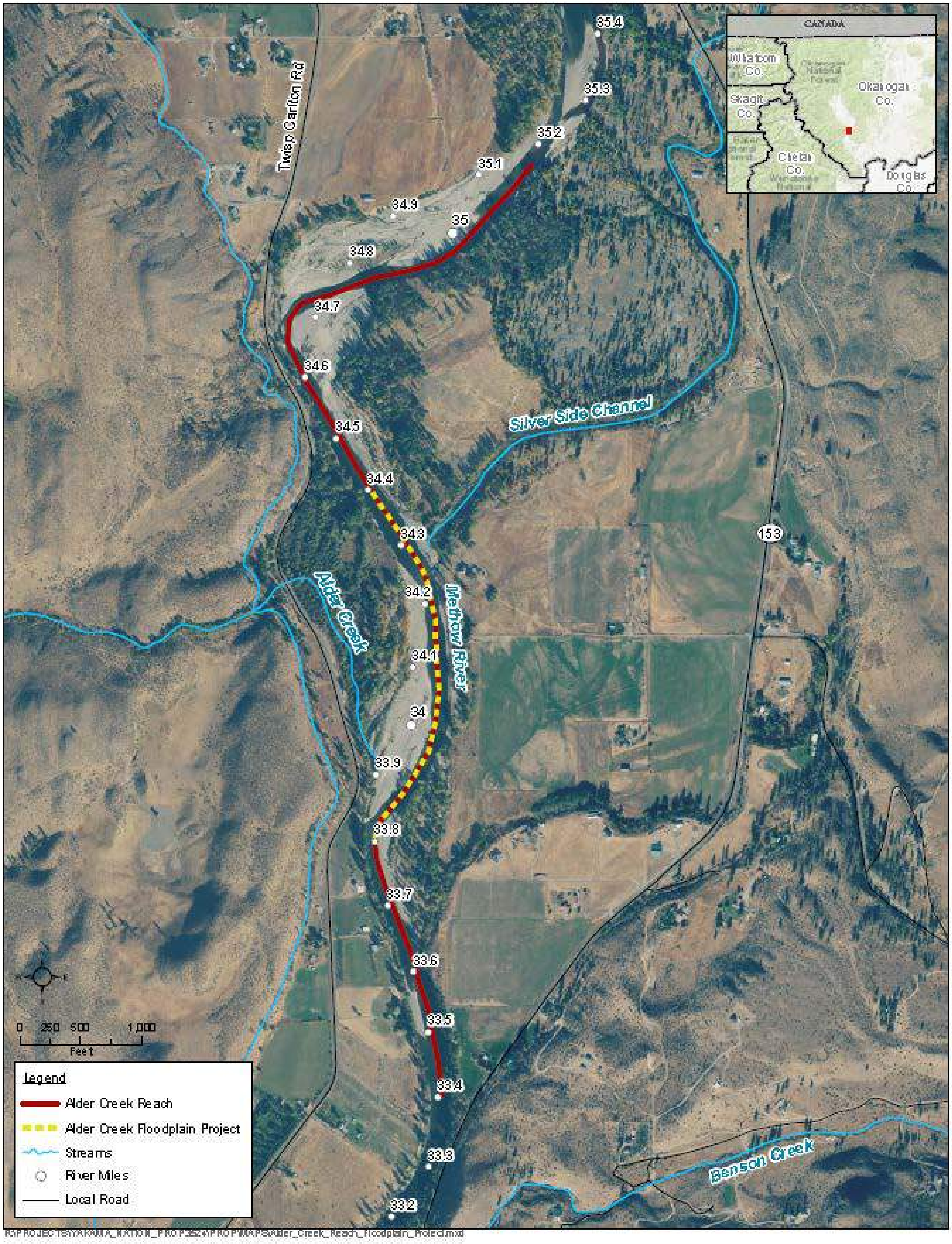

Figure 1-1. Project Vicinity Map

1.2 List of project elements that have been designed by a licensed professional engineer

Project Plan Sheets (see Appendix A), Construction Specifications (see Appendix D), Stability Calculations (see Appendix E), and Engineer's Cost Estimate (submitted separately).

1.3 Identification and description of risk to infrastructure or existing resources

The project is located on the Methow River between river miles (RM) 33.8 and 34.4, approximately 5 miles southeast of Twisp, Washington. Property on the west bank of the project area is publicly owned by the Washington Department of Fish and Wildlife (WDFW), and the east bank and downstream parcels are privately owned rural residential use. Project actions to improve local habitat conditions include adding large woody debris (LWD) structures to improve geomorphic functions and instream habitat complexity and reconnecting a perennial side channel.

Specific locations within the project were identified as areas of concern to infrastructure. The first is the Twisp to Carlton Road along the right bank of the reach from approximately engineering Stations (Sta.) 20+00 to 39+00. The second area of concern is the outlet of the existing Silver Side Channel and the private residence near Sta.45+00, along with a PVC outlet pipe from a small storage pond near Sta.40+00.

Other risks presented by the anticipated project elements include mobilization of LWD, changes to base flood elevations (BFEs), and potential boater safety concerns. The risk of mobilization of LWD will be addressed through project design criteria for stability and construction methods that will create stability through anchoring, ballasting, excavation, and entwining with existing vegetation. The risk of impacts to existing infrastructure will be addressed through consideration of the project disturbance extent and grading plan, design criteria for infrastructure protection, and analyses including hydraulic modeling, shear calculations, and scour calculations. Since the project occurs within a Federal Emergency Management Act (FEMA)-designated floodplain, any changes to the Baseflood Elevations (BFEs) may require certification by Okanogan County and FEMA and remapping of the FEMA floodplain. More discussion on the FEMA floodplain is discussed in Section 3.5.1. Boater safety concerns involve those associated with potential collisions with installed LWD structures and will be evaluated to determine public safety considerations and necessary measures.

Project risk criteria developed for the project include:

- Do not increase risks of flooding or erosion to roads, private structures, culverts, and other public or private infrastructure, including any proposed changes to the established BFEs.
- Provide adequate stability for LWD structures where needed.
- Account for potential boater safety concerns.

1.4 Explanation and background on fisheries use (by life stage - period) and limiting factors addressed by project

1.4.1 Project Background

The Yakama Nation Upper Columbia Habitat Restoration Program is focused on implementing science-based restoration projects in the Upper Columbia River Basin that benefit Endangered Species Act (ESA)-listed fish species. Habitat restoration priorities, objectives, and treatments are guided by *the Upper Columbia Spring Chinook Salmon, Steelhead Recovery Plan* (UCSRB 2007), that also covers bull trout, and by *A Biological Strategy to Protect and Restore Salmonid Habitat in the Upper Columbia Region* (Biological Strategy) (UCRTT 2017). While there are many fish species, both native and introduced, that reside in the Methow River, the project is primarily concerned with future enhancement actions that will benefit ESA-listed spring Chinook salmon (*Oncorhynchus tshawytscha*), steelhead (*O. mykiss*), and bull trout (*Salvelinus confluentus*). Other species may also benefit from these actions, including summer Chinook salmon, sockeye salmon (*O. nerka*), resident rainbow/redband (*O. mykiss gairdneri*), westslope cutthroat trout (*O. clarki lewisi*), mountain whitefish (*Prosopium williamsoni),* and Pacific lamprey (*Entosphenus tridentatus*). Coho salmon (*O. kisutch*) were extirpated from the Methow River, but have been reintroduced and natural spawning has been documented (Galbreath et al. 2014).

1.4.2 Fish Use

As mentioned above, there are three fish populations within the Methow River that are protected under the ESA: spring Chinook salmon, summer steelhead, and bull trout. The Upper Columbia River (UCR) spring Chinook salmon evolutionary significant unit (ESU) was listed as endangered in 1999. This status determination was reaffirmed in 2005. The UCR steelhead distinct population segment (DPS) was originally listed as endangered in 1997, and was relisted as threatened in 2007. The revised status was confirmed in 2009. The National Oceanic and Atmospheric Administration National Marine Fisheries Service (NOAA Fisheries) designated the Methow River and certain tributaries as critical habitat for spring Chinook salmon and steelhead in 2005. Bull trout were listed as threatened in 1999. The U.S. Fish and Wildlife Service (USFWS) designated the Methow River as critical habitat for bull trout in 2010. The Methow River in this reach is an important migration corridor for spring Chinook salmon, steelhead, and bull trout. It contains migration and overwinter rearing habitat for spring Chinook salmon, spawning and rearing habitat for steelhead, and migration, foraging and overwinter habitat for bull trout (Table 1-1).

Table 1-1. Methow River Focal Fish Species Periodicity

Species	Lifestage	Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sept	Oct	Nov	Dec
Spring Chinook Salmon	Adult Immigration & Holding												
	Adult Spawning												
	Incubation/ Emergence												
	Juvenile Rearing												
	Juvenile Emigration												
Summer Steelhead	Adult Immigration & Holding												
	Adult Spawning												
	Incubation/ Emergence												
	Juvenile Rearing												
	Juvenile Emigration												
Bull Trout	Adult Immigration, Emigration												
	Adult Spawning												
	Incubation/Emergence												
	Juvenile Rearing												
	Juvenile Emigration												

Indicates periods of most common or peak use and high certainty that the species and life stage are present.

Indicates periods of less frequent use or less certainty that the species and life stage are present.

Indicates periods of rare or no use.

Ecological concerns (also commonly known as limiting factors) are defined as the physical, biological or chemical features experienced by fish that result in reductions in viable salmonid population parameters (abundance, productivity, spatial structure, and diversity). Several documents discuss ecological concerns/limiting factors within the Methow River Subbasin, including the following:

- Salmon, Steelhead, and Bull Trout Habitat Limiting Factors Report – Water Resources Inventory Area 48 (Andonaegui 2000)
- Methow Subbasin Plan (NPCC 2005)
- Columbia Basin Fish Accords (Three Treaty Tribes-Action Agencies 2008)
- Methow Subbasin Geomorphic Assessment (USBR 2008)
- Federal Columbia River Power System Biological Opinion Tributary Habitat Program (FCRPS 2012)
- A Biological Strategy to Protect and Restore Salmonid Habitat in the Upper Columbia Region. ([Biological Strategy] UCRTT 2017)
- Methow River: Assessment of the Twisp to Carlton Reach (Cardno 2017)

While all these documents provide various descriptions of known ecological concerns/limiting factors, for brevity, this document will only describe the determinations from four of these documents. The Methow River Subbasin plan (NPCC 2005) conducted an Ecosystem Diagnosis and Treatment (EDT) analysis of the subbasin. Sixteen limiting factors were utilized as part of the EDT analysis. The results of this analysis for the Middle Methow geographic area determined that habitat diversity (floodplain connection, off-channel habitat, LWD, riparian vegetation) was the greatest limiting factor to anadromous fish (Table 1-2). Other primary limiting factors were obstructions and channel stability. Secondary limiting factors included key habitat quantity (few quality pools for rearing and holding, and fewer pool tailouts for spawning), sediment load (turbidity, embeddedness, and percent fines), flow (reduced base flow, increased peak flow), and predation. The nine remaining limiting factors were minor or not considered to be limiting to survival (Table 1-2).

Table 1-2. EDT Assessed Limiting Factors for Anadromous Species in the Middle Methow River

Limiting Factors and Ratings	
Habitat Diversity (Primary)	Key Habitat Quantity (Secondary)
Sediment Load (Secondary)	Obstructions (Primary)
Channel Stability (Primary)	Flow (Secondary)
Food (Minor or Not Present)	Temperature (Minor or Not Present)
Predation (Secondary)	Chemicals (Minor or Not Present)
Competition (Hatchery fish), (Minor or Not Present)	Competition (other species), (Minor or Not Present)
Harassment/Poaching (Minor or Not Present)	Oxygen (Minor or Not Present)
Pathogens (Minor or Not Present)	Withdrawals (Minor or Not Present)

Source: NPCC 2005

The Bands of the Yakama Nation were one of three tribes included in a memorandum of agreement with BPA, the U.S. Army Corps of Engineers (USACE), and the U.S. Bureau of Reclamation (USBR). The memorandum, referred to as the 2008 Columbia River Basin Fish Accords (Three Treaty Tribes-Action Agencies 2008), listed four Primary Limiting Factors for the Middle Methow River between Carlton and the Weeman Bridge. Those limiting factors were Ecologic – Community, In-Channel Characteristics, Passage/Entrainment, Pools, and Water Quantity – Flow. These limiting factors applied to both spring Chinook salmon and steelhead.

The revised Biological Strategy document for the Upper Columbia River (UCRTT 2017) contains the most recent information on ecological concerns. This document indicates that within the Middle Methow Assessment Unit (Methow River RM 26.8 to 51.6), the ecological concerns, in descending order of importance, are as follows:

1. Peripheral and Transitional Habitats (Side Channel and Wetland Connections);
2. Channel Structure and Form (Instream Structural Complexity);
3. Channel Structure and Form (Bed and Channel Form);
4. Water Quantity (Decreased Water Quantity);
5. Riparian Condition (Riparian Conditions and LWD Recruitment); and
6. Species Interactions (Introduced Competitors and Predators).

The fourth and most recent document is the Methow River: Assessment of the Twisp to Carlton Reach (Cardno 2017). This reach assessment characterized existing geomorphic conditions and habitat-forming processes, identified enhancement actions to address limiting factors, identified locations for restoration actions, and prioritized sub-reaches for these actions. The project reach is identified as TC2a in the reach assessment (Cardno 2017). The three subreaches comprising the TC2 reach, including TC2a, are identified as presenting the highest restoration potential in the assessment area. Existing conditions, tied to ecological concerns, for the TC2 reach were assessed relative to target conditions, and given a ranking of “Adequate,” At Risk,” or “Unacceptable.” The results shown in Table 1-3 indicate that within TC2, six indicators are ranked “Unacceptable” and three are ranked “At Risk.”

Table 1-3. Existing Versus Target Conditions Ratings for TC2 Reach

Condition/Process	Ecological Concern	TC2 Reach (RM 33.7–40.3) Rating	Existing Condition	Target Condition
Floodplain Connectivity	Side Channel and Wetland Conditions	Unacceptable	Levees and riprap	Off-channel areas are frequently hydrologically linked to main channel; overbank flows occur and maintain wetland functions and riparian vegetation and succession.
Off-channel Habitat	Side Channel and Wetland Conditions	Unacceptable	Levees and riprap, few backwaters	Frequent backwaters with cover, and low energy off-channel areas (ponds, oxbows, etc.).
Channel Migration	Multiple	Unacceptable	Levees and riprap, limited migration	Channel is migrating at or near natural rates.
Wood Frequency	Instream Structural Complexity	Unacceptable	51 pieces per mile	>80 pieces/mile, >12" diameter >5' length and adequate sources of woody debris recruitment in riparian areas.
Key Piece Frequency	Instream Structural Complexity	Unacceptable	<5 key pieces per mile	>16 key pieces/mile with minimum volume of 10.75 m3 (roughly a 35' log, 3.5' diameter, and 7' diameter rootwad).
Pool Frequency	Bed and Channel Form	Unacceptable	8.0 channel widths per pool, diminished LWD	Meets standard of one pool per 6 channel widths and LWD recruitment standards for properly functioning habit.
Pool Quality	Bed and Channel Form	At risk	Pools lack cover	Pools >1 meter deep with good cover and cool water, minor reduction of pool volume by fine sediment.
Canopy Cover within 100 feet	Riparian Condition	At risk	71 percent canopy cover within 100 feet	Trees and shrubs within one site potential tree height distance (100') have >80% canopy cover that provides thermal shading to the river.
Riparian Age Composition	Riparian Condition	At risk	60% large/mature trees	>80% mature trees (medium-large) in the riparian buffer zone (defined as a 30-meter belt along each bank) that are available for recruitment by the river via channel migration.

At risk Unacceptable

Source: Cardno 2017

1.5 List of primary project features including constructed or natural elements

The primary project features were selected based on regional and project goals and objectives as described in Section 1.5.1. Based on those goals and objectives, a variety of constructed or natural design elements were then considered at the Concept Level Design stage (Section 1.5.2) and refined in the Permit Level Design (Section 1.5.3).

1.5.1 Project Goals and Objectives

Key recovery planning efforts that have addressed conditions in the Methow Subbasin include the Methow Subbasin Plan (NPCC 2005), the Upper Columbia Spring Chinook Salmon and Steelhead Recovery Plan (Recovery Plan; UCSRB 2007), the Recovery Plan for the Coterminous United States Population of Bull Trout (USFWS 2015a) and an update to that, the Mid-Columbia Recovery Unit Implementation Plan for Bull Trout

(*Salvelinus confluentus*) (USFWS 2015b), and the revised Biological Strategy (UCRTT 2017). Additionally, in 2012, tribes and state and federal agencies signed the Conservation Agreement for Pacific Lamprey, which was developed "to promote implementation of conservation measures for Pacific Lamprey in Alaska, Washington, Oregon, Idaho, and California" (USFWS 2012).

The goal of the project is to design restoration actions that benefit ESA-listed Chinook salmon, steelhead and bull trout, and address the priority ecological concerns for the Methow River. To address the project goal, the Recovery Plan established regional objectives for habitat restoration along streams that currently support or may support ESA-listed salmonids (UCSRB 2007). The following regional objectives and general recovery actions identified in the Recovery Plan support the development of the restoration strategy for this project.

Regional Objectives

- Protect existing areas where high ecological integrity and natural ecosystem processes persist.
- Restore or maintain connectivity (access) throughout the historical range where feasible and practical for each listed species.
- Protect and restore water quality where feasible and practical within natural constraints.
- Increase habitat diversity by adding instream structures (e.g., LWD, boulders, etc.) where appropriate.
- Protect and restore riparian habitat along spawning and rearing streams and identify long-term opportunities for riparian habitat enhancement.
- Protect and restore floodplain function and reconnection, off-channel habitat, and channel migration processes where appropriate and identify long-term opportunities for enhancing these conditions.
- Restore natural sediment delivery processes by improving road networks, restoring natural floodplain connectivity, riparian health, natural bank erosion, and wood recruitment.
- Reduce the abundance and distribution of non-native species that compete and interbreed with or prey on listed species in spawning, rearing, and migration areas.

In addition to the above, a specific local objective is maintaining a "no rise" condition in the regulatory BFEs.

The revised Biological Strategy (UCRTT 2017) provides specific support and guidance on implementing the 2007 Recovery Plan described above. In the revised Biological Strategy, the Middle Methow is designated as a Priority 2 area (on scale of 1 to 4, with 1 being highest) within the Methow River Subbasin (UCRTT 2017). Restoration priority action types include increasing instream flow and restoring natural geomorphic processes such as channel migration, floodplain interaction, and sediment transport (UCRTT 2017). Ecological concerns and restoration actions recommended for improving these functions are listed in the revised Biological Strategy. These include (in priority order):

1. Peripheral and Transitional Habitats (Side Channel and Wetland Habitat) – Reconnect disconnected side channels, or where low wood loading has changed the inundation frequency, improve hydraulic connection of side channels and wood complexity within side channels; and create groundwater based backwater habitat in areas with suitable hydrology and geomorphology.

2. Channel Structure and Form (Instream Structural Complexity) – Install large wood and engineered log jams (ELJs) in strategic locations to provide short-term habitat benefits and intermediate-term channel form and function benefits. The scale and locations should be consistent with the biological objectives and geomorphic potential for the reach and site.

3. Channel Structure and Form (Bed and Channel Form) – Remove levees; replace undersized bridges; remove bank armoring; and resolve other human impacts such as push up dams.

4. Water Quantity (Decreased Water Quantity) – Improve natural water storage by allowing off-channel connection, floodplain function, and beaver recolonization; and increase stream flow through irrigation practice improvements and water leases/purchases.

5. Riparian Condition – Restore condition in degraded areas associated with residential development, agricultural practices, or where there are legacy effects from past riparian logging practices; improve LWD recruitment, allow regeneration, and stop removal practices so that wood can recruit naturally; and fence riparian areas and wetlands and maintain existing fences.

6. Species Interactions – Reduce or eliminate brook trout in floodplain ponds and Bear Creek.

1.5.2 Concept Level Design

Concept Level Designs (Tetra Tech 2018) were developed for the entire Alder Creek reach (RMs 33.4 to 34.9) based on the topographic and geomorphic site surveys conducted by Tetra Tech; evaluation of existing light detection and ranging (LiDAR) data from 2015 (Quantum Spatial 2016); evaluation of available background documents; and discussion with Yakama Nation Fisheries staff.

The three general alternative strategies that were considered included:

Alternative 1 - Full Floodplain, Fish Passage, and Habitat Restoration
This alternative included restoring stream and watershed processes that create and maintain habitats and biota in an effort to return the project area to its historic and normative state as described by Beechie et al. (2010). Restoration actions under this alternative should address the root causes of degradation.

Alternative 2 - Partial Floodplain, Fish Passage, and Habitat Restoration
This alternative considered an intermediate approach to restore or improve selected processes to partially return the project area to its historic and normative state.

Alternative 3 - Habitat Enhancement
This alternative considered a more site-specific approach to improve the quality of habitat by treating specific symptoms such as the lack of pools or LWD through the creation of locally appropriate habitat structures within the project area. Restoration actions under this alternative provide some local habitat improvements when more holistic process-based options are not available, or may not occur in the short term.

Restoration opportunities were identified during the topographic survey conducted in October 2017. The Concept Level Design Drawings were developed based on the risks identified in Section 1.3, using information collected during the surveys, and reviews of background information. The topographical data in the Concept Level Design Drawings were from field survey data and from the 2015 LiDAR surface.

The selection of proposed actions in the Concept Level Designs was mostly based on the strategy of Alternative 1, except where infrastructure was involved. Specific restoration actions include the following:

- Adding stable LWD structures in the stream channel to increase pool frequency and quality, retain mobile sediment and wood, create split channel conditions, form stable bars, and facilitate reconnection of side channels and adjacent floodplains to create hydraulic diversity and dissipate energy;
- Enhance existing backwater alcoves and pools with additional LWD instream cover;
- Improve connectivity of existing side channels or create new side channels and increase high flow relief;

- Restore wetland function with increased surface water connectivity and a planting plan to reduce invasive reed canary grass.

1.5.3 Permit Level Design

Following review of the Concept Level Design for the Alder Creek Reach (Tetra Tech 2018) by the Yakama Nation Fisheries and stakeholders, authorization was given to proceed with the Permit Level Designs for the Alder Creek Floodplain project area (RMs 33.8 to 34.4) (this submittal).

The proposed design elements are intended to collectively provide a process-based restoration approach to restore historic floodplain and geomorphic process and address priority ecological concerns documented in the revised Biological Strategy (UCRTT 2017). Ecological concerns addressed and habitat benefits provided are summarized in Table 1-4 below.

Table 1-4. LWD Structure Types, Primary Purposes, Locations, and Specific Purposes

Ecological Concern	Habitat Benefits
Peripheral and Transitional Habitats (Side Channel and Wetland Habitat)	• Increased wetted area from activated side channel. • Perennial side channel and groundwater connectivity for low-flow habitat. • Hydraulic complexity and refuge for high-flow habitat. • LWD for cover and habitat complexity for juveniles and adults. • Increased surface water and groundwater interactions for wetland function. • Preservation of existing vegetation.
Channel Structure and Form (Instream Structural Complexity and Bed and Channel Form)	• Provide complex instream and off-channel habitat for juveniles and adults. • Collect mobile wood to increase structure diversity. • Create stable split flow conditions and perennial side channel inundation. • Restoration of historical sediment processes. • Restoration of historical alluvial fan connectivity.
Riparian Condition	• Preservation of existing vegetation and removal of invasive species. • Increased floodplain inundation and groundwater connectivity. • Improved LWD recruitment. • Wetland and riparian plantings.

Specific proposed design elements include the following:

Installation of Log Jam Structure – A Log Jam Structure will be installed at the inlet to the proposed side channel to direct flow into the side channel, create habitat complexity, form complex pools, sort sediment, and collect mobile LWD. This structure has bumper logs for boater safety. Structure stability is provided by pilings and alluvial ballast, with racking packed into the front of the structure to seal it against piping and increase habitat diversity for juvenile and adult species.

Installation of Bank Habitat Structures – A total of 10 Bank Habitat Structures will be installed in the proposed side channel to provide habitat complexity, channel roughness, and lateral stability. Structure stability is provided by alluvial ballast and entwining with existing vegetation.

Installation of 2-Log Cross Structures – A total of 21 2-Log Cross Structures will be installed in the existing Alder Creek channel to provide habitat complexity, channel roughness, and sediment sorting. The structure locations include 3 structures at the confluence of the side channel and Alder Creek, and 18 structures at the lower end of Alder Creek, including the existing alcove where Alder Creek discharges to the Methow River. Structural stability is provided by bolting logs to pilings and supplemental alluvial ballast

Activation of Perennial Side Channel – The Methow River will be reconnected to approximately 1,450 feet of perennially inundated side channel that will discharge to the existing Alder Creek channel. In addition to the perennial connection to the Methow River, the side channel is expected to provide perennial groundwater connectivity, enhancing low-flow cold water conditions for aquatic species. The alignment of the side channel was selected to minimize excavation and to preserve existing vegetation including individual and stands of trees with habitat value for neotropical migrants. Construction of the side channel will require approximately 11,428 cubic yards of excavation. Grade control will be provided by embedding sloped LWD riffle cross structures at the upstream and downstream extents of the side channel.

Wetland Restoration – Following the construction of the side channel, the adjacent staging area will be restored as a wetland by being cleared of invasive reed canary grass, excavated approximately 2 feet, and planted with native wetland species.

An overview of the LWD structure types, primary purposes, locations, and specific purposes is provided in Table 1-5 below.

Table 1-5. LWD Structure Types, Primary Purposes, Locations, and Specific Purposes

LWD Structure Type	Primary Purposes	Locations and Specific Purposes
Log Jam Structure	• Flow-splitting to establish perennial side channel inundation • Capture of transported wood from upstream • Instream cover and habitat diversity • Bumper logs for boater safety	• Sta. 14+40: Structure will provide flow splitting for perennial inundation of side channel.
Bank Habitat Structures	• Instream cover and habitat diversity • Channel hydraulic roughness • Channel lateral stability	• Sta. 0+50, 2+00, 4+00, 6+00, 7+00, 9+50, 11+00, 13+00, 13+50, and 14+00: Structures will provide habitat complexity, hydraulic roughness, and lateral stability at side channel bends. Structures will provide low- and high-flow habitat for juveniles and adults.
2-Log Cross Structures	• Instream cover and habitat diversity	• 21 2-log structures total: o 3 structures at confluence of side channel and Alder Creek. o 18 structures at lower end of Alder Creek. • Structures will provide low- and high-flow habitat for juveniles and adults.

1.6 Description of performance / sustainability criteria for project elements and assessment of risk of failure to perform, potential consequences and compensating analysis to reduce uncertainty

Performance/sustainability criteria for project elements, including associated risks to infrastructure or risk of failure to perform, and compensating analyses will be fully developed at later design stages. These criteria are intended to ensure that the engineering design meets project objectives and maintains compliance with applicable codes, standards, and established criteria. General performance/sustainability criteria at this design stage include:

- Maintain a no-rise in the established FEMA regulatory BFEs.

- Channel enhancement and restoration (e.g., increased channel complexity, increased habitat diversity, and activation of historic channels).
- LWD structure stability and performance criteria (e.g., pile anchoring, ballast, bank protection, deposition, pool scour).
- Add boater safety elements to LWD structures where needed.
- Floodplain enhancement and reconnection (e.g., increased floodplain connectivity, increased frequency of side channel inundation, and decompaction of hardened surfaces).
- Protection of existing infrastructure and landowner property.

Performance criteria for project elements, including associated risks to infrastructure or failure to perform, and compensating analyses are summarized in Table 1-4. Performance criteria and habitat benefits for LWD structures are provided in Table 1-5.

Table 1-4. Project Actions and Performance Criteria

Project Actions	Performance Criteria	Risk Assessment	Compensating Analyses or Measures
Side Channel Creation or Reactivation	• Increase floodplain inundation at lower flows. • Provide perennial flow in side channel. • Increase hydraulic connectivity to existing wetlands.	• The proposed side channel will be excavated into floodplain deposits of native alluvium. • Potential for unanticipated geomorphological and/or flow changes. • Potential for channel dewatering and fish stranding. • Wetland and beaver pond hydrology changes. • Impacts to existing vegetation.	• Hydrologic and hydraulic analyses to ensure delivery of perennial design flows. • Velocity and shear stress calculations for lateral stability and sediment transport. • Incorporation of groundwater and wetlands data. • Incorporation of climate change into proposed conditions hydraulic analyses. • Minimization width of channel excavation and avoidance of existing vegetation.
Large Wood Structures	• Promote development of split flow for perennial side channel connectivity. • LWD structures to be stable up to the 100-year flood • Increase pool frequency and complexity. • Hydraulic roughness and habitat complexity. • Lateral and vertical channel stability.	• Potential for increased flows into side channel. • Potential for deflection of primary flow paths towards channel banks resulting in increased bank erosion. • Boater safety.	• LWD stability calculations. • Structure stability enhanced with pilings and ballasting alluvium. • Shear stress estimates. • Hydraulic analysis. • Bumper logs for boater safety for Log Jam Structures and location of other structures away from main channel thalweg, reducing impacts to boaters.
Alcove Enhancement	• Increase cover and increase scour of alcove pool.	• Like natural alcoves, may fill in with fines over time, but overall risk is low.	• No alcove excavation is proposed. • Addition of LWD structures for cover, habitat complexity, and scour.
Revegetation	• Revegetation of all disturbed areas. • 12-month plant survival of >75 percent. • Wetland restoration of staging area.	• Potential for low survival and ungulate browsing • Noxious weed infestations.	• Lowering of staging area approximately 2 feet. • Restoring staging area with wetland species. • Use site appropriate native vegetation, and preserve and replant existing native vegetation where feasible. • Technical specifications for plant handling, care, installation, and survival. • Noxious weeds shall be monitored and removed.
Site Access, Staging, and Materials Handling	• Compliance with existing easement and authorized land uses. • Equipment staging and refueling area 150’ from wetland or river or closer with approved variance.	• Potential for impacts to the site and existing approved site uses. • Potential for impacts to property owners during construction.	• Development of site access, staging, and materials plans. • Document compliance with existing easement and authorized land uses, including the riverbank fishing easement, mule deer winter range and migratory corridors, recreation, and parking. • placement of fill on uplands area to the west of the project area.
Construction Sequencing	• Minimize site and resource impacts. • Compliance with environmental permitting requirements.	• Potential for impacts to the site and associated resources.	• Development of construction sequencing plan. • Construction during low-flow period (after in-water work window) to minimize impacts to wet areas.

1.7 Description of disturbance including timing and areal extent and potential impacts associated with implementation of each element

According to WDFW guidelines, the in-water work window for the Methow River upstream of Carlton is July 1 to July 31. Construction is not yet scheduled but may occur after the WDFW in-water work window during low water to minimize construction impacts to wet areas. A preliminary construction schedule is provided in Section 4.5. The specific areal extent of disturbance of approximately 8 acres was developed based on the results of the survey and hydraulic modeling. Potential impacts include impacts from noise and dust, temporary turbidity releases to the stream, minor impacts to resident fish populations from de-fishing activities, possible spills from construction equipment, colonization of disturbed ground by invasive vegetation, short term disturbance issues for landowners, and damage to existing vegetation along designated access routes.

A site-specific wetland delineation was completed in 2018 for the project (Interfluve 2018). The delineation classified 11 separate wetlands as A through K in the project area, not including the Methow River and the minor tributary Alder Creek. The wetlands are primarily riverine depressions or high-flow side channels adjacent to the Methow River. One of the wetlands is a large beaver pond complex containing multiple beaver dams. All the wetlands are classified as either WA Category II or III. The mapped wetlands are illustrated throughout the design sheets in Appendix A. Overall impacts to the wetlands will be minimized through incorporation of HIP III Best Management Practices (BMP's) and conservation measures (see Section 4.1). In addition, this project will improve wetland conditions through increased surface water inundation to wetland areas.

2. RESOURCE INVENTORY AND EVALUATION

2.1 Description of past and present impacts on channel, riparian and floodplain conditions

Substantial anthropogenic impacts to the Methow River began with beaver trapping in the early 1800s, which started affecting riparian conditions and off-channel water storage. Gold and silver mining occurred in the subbasin during the 1870s to 1890s, resulting in the establishment of several mines near the town of Twisp. These mines resulted in a large influx of settlers and merchants, with orchards and livestock production starting in the late 1800s. Water diversion for the mines and supporting agriculture began in the 1880s, which reduced streamflow and impacted anadromous fisheries. Timber harvest in the subbasin started in the 1920s, peaking in the 1980s. Additionally, while wildfires are an integral part of the subbasin ecology, recent fires have been substantially more frequent and devastating. These fires have removed ground and canopy cover from large areas, resulting in decreased stream shading and increased sediment and turbidity inputs (NPCC 2005; Cardno 2017).

Current impacts to existing channel, riparian, and floodplain conditions stem from many of the above-mentioned sources as well as modern infrastructure and development. Modern logging practices across the watershed and the loss of large riparian trees due to agricultural practices eliminated the natural supply of wood which had historically helped establish large wood bar-apex structures. In addition, large wood within the channel was likely systematically removed from the river by residents, farmers and recreational river users. While timber harvest has been reduced in scope from previous harvest levels, it still occurs at more limited levels at higher elevations in the subbasin. Riparian corridors along the mainstem Methow River, particularly between Carlton and Wolf Creek, are considered in poor condition due to previous timber harvest and adaptation of the surrounding properties to orchards and livestock pastures, with only a narrow band of trees in many areas (USBR 2008).

The Methow River: Assessment of the Twisp to Carlton Reach (Cardno 2017) documented the changes to river and floodplain processes caused by historical and modern hydro-modifications including levee construction, roadways, bank armoring, and bridge abutments in this reach. The TC2 reach alone contains almost a mile of levees and more than three miles of total bank hardening, part of the more than six miles of total bank hardening in the Twisp to Carlton Reach (Cardno 2017). The hydro-modifications have caused the river to become constrained compared to the historical condition, directly cutting off large areas of the floodplain and historical off-channel areas. The resulting increased flow depth and velocities through the project area mobilized larger key member pieces of woody debris and bed-material particles, resulting in less wood and a coarser stream bed than what persisted under natural conditions. As a result, gravel bar islands are regularly washed downstream with rapid channel migration rates. The increased flow depth and velocities has also reduced the frequency of floodplain inundation and the number of low-flow side channel habitats in the reach.

2.2 Instream flow management and constraints in the project reach

As discussed above, water quantity/decreased flows are a known limiting factor in the Methow River. This limiting factor is exacerbated by the current levels of water outtake for irrigation. One estimate of withdrawals (Ely 2003) puts the water take at 230 cubic feet per second (cfs), approximately half of the flow during summertime. These withdrawals are all located above the project area. Additionally, segments of the Methow River have been 303(d) listed as Category 4C for instream flow, meaning that the impairment is due to non-pollutants, and cannot be corrected by a Total Maximum Daily Load (TMDL) plan.

2.3 Description of existing geomorphic conditions and constraints on physical processes

Previous geomorphic work has been performed for the Methow River in the general vicinity of the project. The Methow Subbasin Geomorphic Assessment (USBR 2008) covers the entire Methow Subbasin. The USBR also performed a geomorphic assessment with hydraulic modeling of the middle Methow River (Winthrop to Twisp), which is still applicable to the project (USBR 2010). The Methow River: Assessment of the Twisp to Carlton Reach (Cardno 2017) includes a summary of geomorphic conditions of the Methow River from RM 28.1 to RM 41.3. The summary includes reach level data such as sinuosity, gradient, average bankfull and floodprone widths, percentage of habitat unit area and habitat unit spacing. Geomorphic and habitat characteristics specific to Alder Reach are provided in Section 3.

The Methow River within the Alder Creek reach primarily consists of long riffles and glides, with less frequent but deep pools. Several sizeable bars have formed in this reach, however, due to the lack of stabilized large wood structures, high water often washes away vegetation, preventing mature vegetation from becoming established. Along the east bank of the river the floodplain is unconfined laterally for most of the project length (Figure 2-1). Along the west bank much of the river is confined by hillslopes and bedrock, except for the unconfined floodplain at the confluence with Alder Creek.

Figure 2-1. Example of Project Reach Geomorphic Conditions looking toward the east bank of the Methow River

2.4 Description of existing riparian condition and historical riparian impacts

Historical impacts to the riparian community are similar to other drainages in the region. After establishment of European homesteads and communities in the 1880s (particularly the establishment of the town of Twisp) logging and agricultural development were major factors in removing most of the existing vegetation community, resulting in the current sparse riparian zone around the project.

Descriptions of the existing riparian condition are described in previous surveys of the Methow River. The Yakama Nation Fisheries (YNF 2012) describes the mainstem Methow River riparian areas as in poor condition, especially between Carlton (RM 27.5) and Wolf Creek (RM 53), noting lack of mature cottonwoods (*Populus balsamirfera* ssp. *trichocarpa*) in the floodplains and riparian areas. The assessment completed by Cardno (2017), which covers the Twisp to Carlton reach, also indicates that much of the riparian vegetation consists of cottonwoods, interspersed with ponderosa pine (*Pinus ponderosa*) and willows (*Salix sp.*). The dominant size classes for this assessment were classified as Small Trees (9 to 20.9 inches diameter), and Large Trees (21 to 31.9 inches diameter). In their final determination of the riparian community, the Cardno assessment indicated that both banks of the assessment reach were significantly reduced from historic levels.

Project reach surveys showed that the existing riparian corridor in the Alder Creek reach consists primarily of mature black cottonwoods and ponderosa pine overstory, with understory made up of willows, hawthorn (*Crataegus* sp.), alder (*Alnus* sp.), ocean spray (*Holodiscus discolor*), and red osier dogwood (*Cornus sericea*).

The ground cover includes patches of rose (*Rosa* sp.) and grasses, including some exotics such as reed canary grass (*Phalaris arundinacea*). The recolonizing vegetation on the river bars consists of young cottonwoods and willows. Overall vegetation density is high near the Alder Creek and Silver Side Channel confluences, but low to moderate in the remaining portions of the reach. Figure 2-2 illustrates the riparian vegetation community at the downstream portion of the project reach.

Figure 2-2. Riparian Corridor Conditions near RM 33.5

2.5 Description of lateral connectivity to floodplain and historical floodplain impacts

The project area is generally an unconfined, low gradient, depositional portion of the Methow River. The floodplain connectivity has been reduced from historic levels due to previously described impacts, however, because this project falls within lands protected by WDFW, there are many opportunities for floodplain reconnection. Flood inundation figures illustrating connectivity at the 2– and 100–year flood recurrence intervals for existing and proposed conditions for the Golden Doe project area are provided in Appendix B.

3. TECHNICAL DATA

3.1 Incorporation of HIP III specific Activity Conservation Measures for all included project elements

The BPA HIP III Handbook Version 4.1 (BPA 2016) identifies General Aquatic Conservation Measures Applicable to all Actions that include:

- Project Design and Site Preparation;
- Work Area Isolation & Fish Salvage;
- Construction and Post-Construction Conservation Measures;
- Staged Rewatering Plan;

- HIP III Turbidity Monitoring Protocol;
- Stormwater Management Guidance; and
- Terrestrial Plants, Wildlife, and Aquatic Invertebrates.

Restoration action categories and risk levels applicable to the project will be identified by the BPA Restoration Review Team (RRT) and included in future design stages.

3.2 Summary of site information and measurements (survey, bed material, etc.) used to support assessment and design

The following sections describe site information for the entire Alder Creek reach that was collected to support the assessment and design alternatives.

3.2.1 Topographic Surveys and Surface Development

Consistent with the direction provided by the Washington Board of Registration for Professional Engineers and Land Surveyors for incidental survey work, site surveys were conducted under the direction of a licensed professional engineer and are intended for his or her own use toward the development of an engineered design.

The field-collected topographic survey data for the project were acquired on October 18 to 19, 2017 and September 4, 2018, and included stream channel topographic and bathymetric northing, easting, and elevation Global Positioning System (GPS) coordinates, as well as geomorphic and habitat assessments. Additional GPS locations and descriptions of key features including infrastructure such as road crossings, bridges, levees, well heads, overhead powerlines, edges of pavement, and other points of interest were collected during field surveys. Data were acquired using a Trimble R10 real time kinetic (RTK) GPS with Global Navigation Satellite System (GLONASS) receivers operating from established control points. Three survey control points were established by collecting raw static GPS data for a minimum of 2 hours. Tetra Tech staff sent the data in to the Online Positioning User Service (OPUS) for post-processing and conversion to the preferred coordinate system: North American Datum (NAD) 83, Washington State Plane, North Zone, horizontal projection, and to the North American Vertical Datum (NAVD) 88, using U.S. survey feet as the vertical projection. A National Geodetic Survey (NGS) vertical control benchmark (F389) located about 300 feet east of the downstream end of the project, and adjacent to State Highway 153, was also surveyed and published data were compared against GPS data. The field collected elevation for the NGS benchmark was 1509.916 versus the reported NAVD 88 Ortho height of 1509.997, a difference of 0.081 feet.

The topographic survey involved collecting 4,825 GPS coordinates, and included a longitudinal profile of the thalweg, waters edges, bankfull, and all major breaks in slope necessary for hydraulic analyses, covering over 8,200 feet of river (Figure 3-1). The project reach for the Alder Creek Floodplain section is from Sta. 22+00 to 55+00. The channel thalweg was surveyed at approximately 20-foot intervals capturing all major breaks in slope along the channel profile.

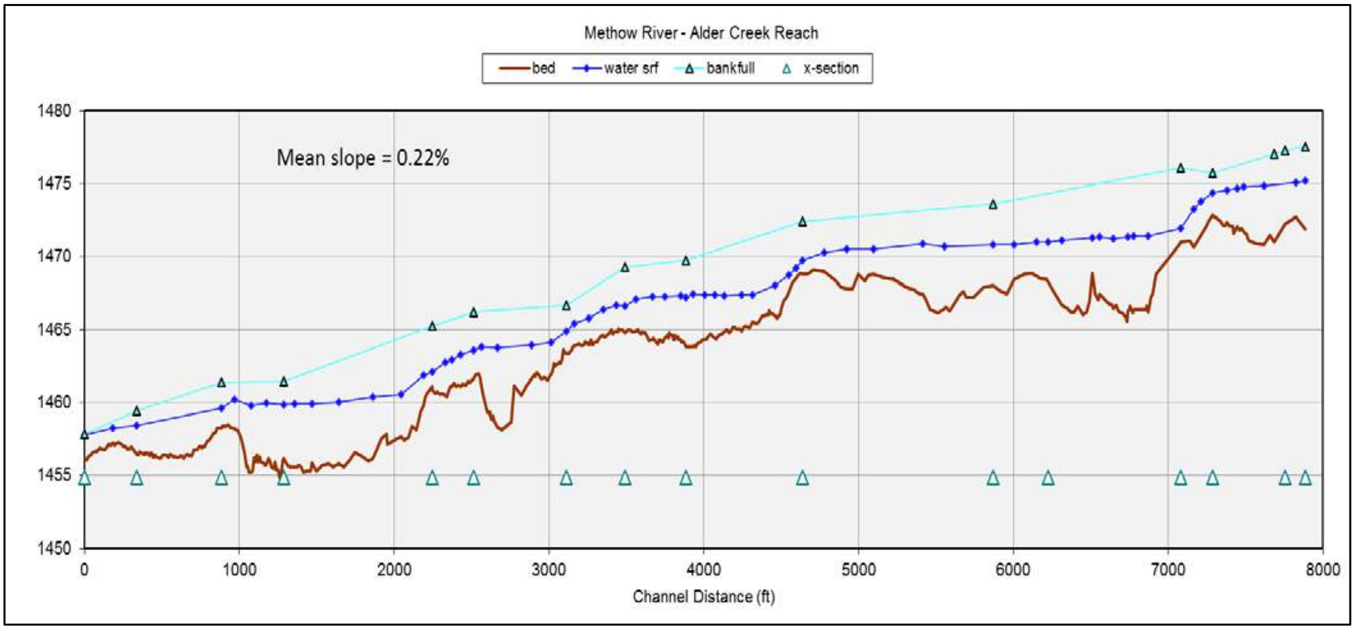

Figure 3-1. Longitudinal Profile of the Methow River, Alder Creek Reach

A total of 16 cross sections were surveyed. Additional data such as intermediate channel bottom and gravel bar data was collected throughout the reach to improve the surface resolution for suitability of 2D modeling and to account for any changes in bed or banks that occurred following the 2015 LiDAR flight.

Traditional LiDAR data were acquired in 2015 (Quantum Spatial 2016). Traditional LiDAR laser pulses do not penetrate water surfaces, but rather reflect off the surface. Therefore, in order to produce an accurate channel bed surface for hydraulic modeling and designs, the water surface data was removed and replaced with field collected GPS bathymetric data. LiDAR data were compared against field collected GPS points to determine if any adjustments of the data were required. These comparisons indicated that no horizontal or vertical adjustments to LiDAR northing, easting, or elevation data were needed. The survey data was merged with the 2015 LiDAR data to provide a final surface for hydraulic modeling and design development.

3.2.2 Geomorphic and Habitat Data Collection and Observations

Geomorphic and habitat data were collected during the field survey and detailed potential restoration actions, site photographs, and related notes were recorded on iPads. These data were gathered to characterize current in-channel and riparian habitat, establish baseline conditions in the Methow River, and identify potential restoration opportunities. During field data collection, specific attention was given to observations related to sediment transport and response conditions, channel incision and channel stability trends (erosion or aggradation), substrate characteristics (e.g., size, distribution, supply), the abundance and influence of instream wood, floodplain connectivity, the influence of human alterations, and the interaction of the stream with riparian ecological processes.

Table 3-1 illustrates the existing conditions geomorphic characteristics calculated from survey data including channel gradient, sinuosity, bankfull width and depth, bankfull cross-sectional area, width-to-depth ratio, floodprone width, and entrenchment ratio. The existing channel morphology (Montgomery and Buffington 1997) and stream type (Rosgen 1996) was also evaluated based on field data and observations. Existing conditions habitat data collected during field surveys were used to calculate pool spacing, and the length and percent composition of habitat units (i.e., runs, riffles, glides, and pools), as shown in Table 3-1.

Table 3-1. Methow River, Alder Creek Reach Geomorphic and Habitat Characteristics

Site Characteristics	Existing Conditions
Stream Length (feet)	7,884
Channel Gradient (percent)	0.22
Sinuosity	1.18
Bankfull Width (feet)	204
Bankfull Depth (feet)	2.5
Bankfull Cross Sectional Area (square feet)	507
Width-to-Depth Ratio	82.1
Floodprone Width (feet)	550
Entrenchment Ratio	2.7
Channel Morphology	Pool-Riffle
Rosgen Stream Type	C3/4
Pool-to-Pool Spacing (feet)	1,300
Percent Run	0
Percent Riffle	38.2
Percent Glide	37.4
Percent Pool	24.4

Additional geomorphic data collected during field surveys included two pebble counts using sampling methods similar to those described in Bunte and Abt (2001). The pebble count substrate samples were collected both at the upstream and downstream extent of the project area. Table 3-2 contains the sediment characteristic metrics for characteristic grain sizes (e.g., D_{50}, D_{84}), and the percentages based on size categories (percent fines, gravels, cobbles, boulders, and bedrock) of the bed material. The sediment grain size distributions are shown in Figure 3-2 (lower site) and Figure 3-3 (upper site).

Table 3-2. Sediment Sizes and Distribution for the Methow River, Alder Creek Reach

Substrate Size Characteristics	Lower Sample Site	Upper Sample Site
Percent Silt/Clay	0%	0%
Percent Sand	0%	0%
Percent Gravel	28%	52%
Percent Cobble	72%	48%
Percent Boulder	0%	0%
D_{16} (mm)	43	25
D_{35} (mm)	71	45
D_{50} (mm)	87	61
D_{65} (mm)	110	90
D_{84} (mm)	140	120
D_{95} (mm)	170	150

mm – millimeter

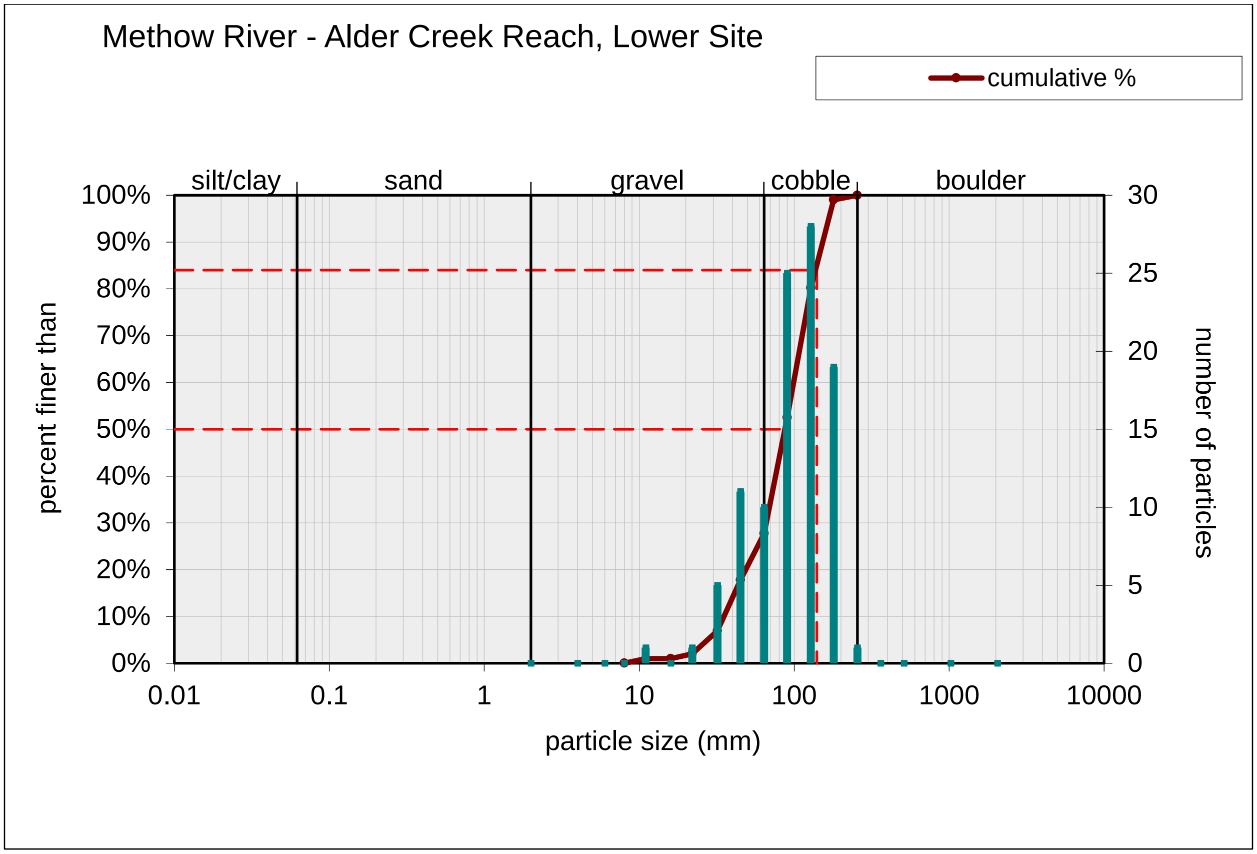

Figure 3-2. Substrate Grain Size Distribution for the Downstream Sample Location

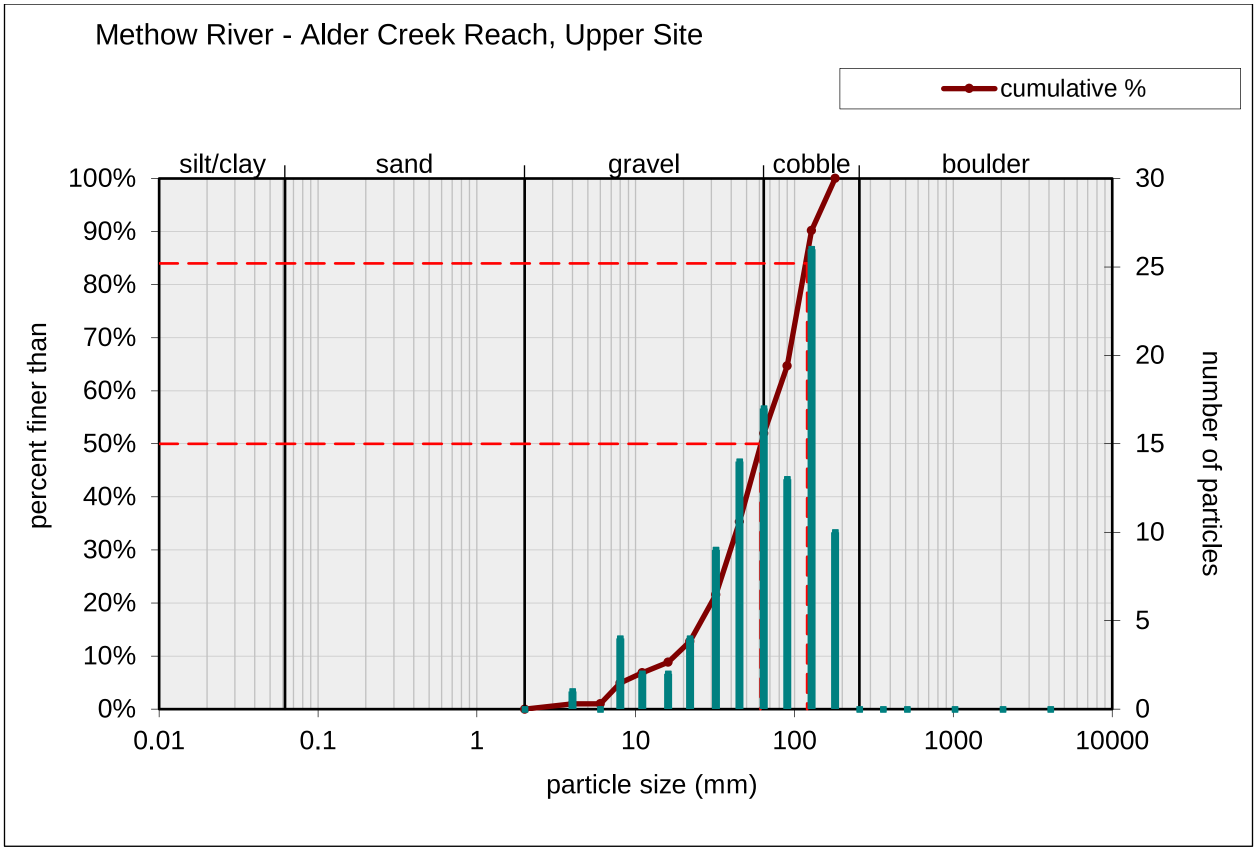

Figure 3-3. Substrate Grain Size Distribution for the Upstream Sample Location

Tetra Tech mapped the active channel, defined here as exposed gravel bars, islands, and wetted channel, in the project reach using historical aerial imagery from 1945, 1953, 1968, 1975, 1990, 2006, and 2017. The channel centerline, here defined as the center between the left and right bank lines, was also mapped for each year of aerial photography. Lastly, the channel thalweg was estimated using aerial imagery from 1990, 2006, and 2017. Results are provided in Appendix C.

Figure 1 in Appendix C shows the active channel migration from 1945 to 1975. The major trends in the area include the abandonment of what is now referred to as the Silver Side Channel between 1945 and 1953. Further downstream, the active channel width of the river widens substantially between RM 34.3 and 33.6. Figure 2 in Appendix C shows the active channel migration between 1990 and 2017. Of note is the widening of the active channel between RM 35 and RM 34.6 as well as between RM 34.3 and RM 33.8 as well as the average migration of the channel of 8 feet per year to the west between RM 35 and 34.5.

Figure 3 in Appendix C illustrates the migration of the channel centerline between 1945 and 1975. Again, the major event is the abandonment of the Silver Side Channel between 1945 and 1953. Also of note is the gradual migration of the channel centerline from west to east between RM 34.2 and RM 33.6. Figure 4 in Appendix C illustrates the migration of the channel centerline for the Methow River between 1990 and 2017. Of note here is the migration of the centerline from east to west between RM 34.7 and RM 34.2 as well as the migration from west to east between RM 34.2 and RM 33.7. The average migration rate is 7 feet per year between RM 34.7 and RM 34.2 while the average rate is 5 feet per year between RM 34.2 and 33.7.

Figure 5 in Appendix C illustrates the migration of the channel thalweg between 1990 and 2017. Specific attention was paid to the migration near the inlet of the proposed side channels near RM 34.4 and RM 33.95. At the inlet of the side channel near RM 34.4, the thalweg has generally migrated east to west (towards the inlet) at a rate of 4.5 feet per year. At the inlet of the side channel near RM 33.95, the thalweg has generally migrated west to east (towards the inlet) at a rate of 15 feet per year.

Generally, the migration of the channel is limited between RM 33.9 and RM 33.3 by the Twisp-Carlton Road and the banks along the properties on both the left and right banks. Between RM 35 and RM 34.3 the river is also constricted on the right bank by the Twisp-Carlton Road and the heavily vegetated right bank. Occupation of the Silver Side Channel at high flows could further expand the active channel area in the upper section of the reach

3.3 Summary of hydrologic analyses conducted, including data sources and period of record including a list of design discharge (Q) and return interval (RI) for each design element

The project resides in the 5th field Hydrologic Unit Code (HUC) Middle Methow watershed (HUC 1702000806). There has been other hydrologic analysis performed for the Methow River, including the entire Twisp to Carlton reach. The Methow River Subbasin Geomorphic Assessment (USBR 2010) includes a description of the hydrology of the Methow River directly above the project site. The Methow River: Assessment of the Twisp to Carlton Reach (Cardno 2017) includes a description of the hydrology of the Methow River for the entire reach. The U.S. Geological Survey (USGS) has operated gage (#12449500) near the town of Twisp from 1919 to the present day, totaling 64 annual peak flow records. The peak flow record does not include any values from 1963 to 1990. The gage is immediately downstream of the Twisp River confluence and approximately 2,000 feet upstream of the Highway 20 bridge in Twisp and has a drainage area of approximately 1,301 square miles (USGS 2018). A flood flow frequency analysis was performed utilizing HEC-SSP, version 2.1.1 (USACE 2017), and Bulletin 17B Methods (USGS 1982) for computing statistic and confidence limits. While performing the analysis, a record flood event in 1942 was recognized as a high outlier and a record low flow event in 1926 was recognized as a low outlier. Both outliers were removed using the outlier test available in HEC-SSP.

The drainage area of the Methow River at the downstream end of the project reach (RM 33.4) is approximately 1,450 square miles. The gage values were adjusted using a basin-area ratio and regional adjustment factors (Cooper 2006). The basin area ratio was approximately 1.1 and lies within the acceptable USGS range of 0.5 to 1.5 to perform a gage transfer. The gage transfer analysis was preferred over the Washington State Flood Regression Tool (USGS 2016) duration of records from the gage (64 annual peak flow records), and engineering experience and judgement.

The FEMA 1977 Flood Insurance Study (FIS) report (FEMA 1977) for the Town of Twisp references a method of using discharge records for gaging stations, miscellaneous measurements of streamflow, and discharge data from other stations on the Methow and adjoining river basins that were utilized in a flood flow frequency analysis and included the 1948 and 1972 floods. Results of the analysis computed frequency discharge and drainage area curves presented on a log scale for the Methow River and Twisp River. Using the FEMA project drainage area of approximately 1,300 square miles, the estimated 100-year FIS flow is 35,000 cfs.

The FEMA 2003 FIS report (FEMA 2003) for Okanogan County Unincorporated Areas references a 100-year peak flow value of 34,000 cfs on the Methow River at the confluence with the Chewuch River near Winthrop. The FEMA project drainage area for this study is approximately 1,250 square miles. Both FEMA FIS 100-year peak flow values are larger than the Tetra Tech estimated value using the gage transfer analysis.

The project reach is close to the Town of Twisp and is shown to be in a Zone A5 detailed floodplain on Flood Insurance Rate Map Panel (FIRM) #530117-1050B, revised February 10, 1981. This FIRM is listed as part of the Okanogan County Unincorporated Areas FIS report, which listed a 100-year flow of 34,000 at 1,250 square miles. However, the approximate drainage area from the Town of Twisp FIS is closer to the project area. Therefore, the project No-Rise and project risk for the 100-year flood will be modeled, evaluated and compared using both the gage transfer and the FEMA 100-year flow value for the Town of Twisp FIS. No attempt was made to extrapolate beyond the available data to perform a gage transfer analysis for the FEMA 100-year flow value of 35,000 cfs from 1,300 square miles to 1,450 square miles for the project reach.

Table 3-3 below illustrates the Tetra Tech flood flow frequency analysis for the gage using HEC-SSP and Bulletin #17B Methods, results of the gage transfer peak flow values, and the estimated FIS flows.

Table 3-3. Flood Flow Frequency Analysis, Gage Transfer Results and FIS Estimated Flows

Return Period (years)	Annual Exceedance Probability (AEP) (percent)	Gage #12449500 Peak Flow (cfs)	Gage #12449500 Transferred to Project Reach (cfs)	Estimated FIS Flows (cfs)
2	50	11,160	12,276	NA
5	20	15,782	17,318	NA
10	10	18,877	20,682	21,500
25	4	22,812	24,946	NA
50	2	25,759	28,135	31,500
100	1	28,717	31,328	35,000

cfs – cubic feet per second
FIS – Flood Insurance Study
NA – Not Applicable

In 2017, Cardno performed a gage record extension for USGS gage #12449500 near the Town of Twisp using a regression analysis with USGS gage near Pateros (#12449950). The reported drainage area for gage #12449950 is approximately 1,772 square miles. The peak flow record for this gage is from 1959 to current. A summary of the Bulletin #17B results from the record extension analysis is shown in Table 3-4 and compared to the results shown above for only the #12449500 gage record without using a record extension. The values estimated from the original gage record have slightly more conservative values and will be the flows chosen for the hydraulic modeling and design analyses.

Table 3-4. Flood Flow Frequency Gage Analysis Comparison

Return Period (years)	Annual Exceedance Probability (AEP) (percent)	Extended Gage #12449500 Record Flows (cfs)	Extended Gage #12449500 Record Transferred to Project Reach Flows (cfs)	Original Gage #12449500 Record Transferred to Project Reach Flows (cfs)
2	50	11,203	11,380	12,276
5	20	15,903	16,150	17,318
10	10	19,053	19,344	20,682
25	4	23,061	23,407	24,946
50	2	26,062	26,449	28,135
100	1	29,075	29,502	31,328

cfs – cubic feet per second

Finally, Tetra Tech evaluated inflow from Alder Creek to the west entering the Methow River. A StreamStats watershed delineation report was generated and resultant parameters were inserted into regional regression equations to estimate peak flow values. The Washington State Flood Regression Tool (USGS 2016) estimates flood discharges based on basin characteristics and location within the state. The results of the regression analysis are provided in Table 3-5.

Table 3-5. Alder Creek Reach Regression Results

Return Period (years)	Annual Exceedance Probability (AEP) (percent)	Regression Peak Flows (cfs)
2	50	23.2
5	20	47.7
10	10	70.7
25	4	106
50	2	140
100	1	177

cfs – cubic feet per second

The recurrence interval for bankfull discharge is typically around 1.5 to 2 years but can range from 1 to 32 years (Hey 1997). Tetra Tech evaluated the 2-year recurrence interval in the hydraulic model for comparison against bankfull survey points collected from the topographical field data. Upon completion of the existing conditions hydraulic model, bankfull survey points matched up accurately with the 2-year recurrence interval results.

The potential impacts of climate change on flows in the project reach were considered using climate change predictions compiled by the USFWS for the Methow River (USFWS 2013). The USFWS completed a hatchery climate change vulnerability study for changes in flow and temperature in the Methow River predicted through 2040 (USFWS 2013). The study suggested that monthly surface flows in the Methow River are projected to increase from October to May when compared to the 10-year baseline from 2000 to 2009. Flows are projected to decline in June (-22.5 percent), July (-47.0 percent), August (-32.6 percent), and September (-17.2 percent). The September climate change predicted flow in 2040 is 372 cfs, a reduction from the baseline September flow of 449 cfs.

The additional decrease of approximately 25 cfs under the USFWS climate change predictions from the modeled early October flow in 2017 of 397 cfs has the potential to disconnect the proposed side channels based on the design topography. See Appendix B for a figure showing the estimated 2040 low inundation extents under proposed conditions. However by 2040, the geomorphology and planform of the Methow River most likely will be quite different from present based on the changes observed in the aerial imagery record, and the project design is expected to enhance resiliency through improved river function. The higher winter flows predicted in the USFWS study have been incorporated into the design by using the original gage record's higher peak flows, providing a conservative design approach for potential increases in peak flows.

Table 3-6 illustrates the gage transfer peak flows for the Alder Reach and the Washington State Flood Regression Tool peak flows for Alder Creek that were used in the hydraulic model for evaluation against depth, velocity, and shear stress to support proposed restoration design improvements.

Table 3-6. Project Peak Flows

Return Period (years)	Project Reach Peak Flows (cfs)	Alder Creek Peak Flows (cfs)
2	12,276	23.2
5	17,318	47.7
10	20,682	70.7
25	24,946	106
50	28,135	140
100	31,328	177

cfs – cubic feet per second

3.4 Summary of sediment supply and transport analyses conducted, including data sources including sediment size gradation used in streambed design

Under natural conditions, alluvial river systems tend towards a balanced state in which some erosion and deposition occurs during sediment transporting events but no net change in dimension, pattern, and profile occurs over the course of years. These systems are frequently referred to as regime channels which are in a state of dynamic equilibrium. Changes in the boundary conditions including sediment supply, channel form modification, flow, or bank strength can upset the balance leading to a trend of aggradation or incision. In the case of Methow River, channel form modifications have caused channel incision that has resulted in a loss of floodplain connectivity and altered sediment transport processes.

Using the sediment size analyses described in Section 3.2 above and the results of the hydraulic analysis described in Section 3.5 below, an analysis of the channel sediment mobility (threshold of motion grain size) was performed for the proposed side channel. The analysis was performed by comparing the incipient motion critical shear stress, the shear stress required to initiate particle motion, to the average shear stress in the side channel during bankfull flow. The following table represents the gradation and incipient motion summary of the existing streambed material.

Table 3-7. Gradation and Incipient Motion Summary

% Finer	Streambed Cobble (mm)	Streambed Cobble (in)	Incipient Motion Critical Shear (psf)
D_{16}	16	1.9	0.8
D_{50}	74	2.9	1.3
D_{84}	130	5.1	2.4

mm = millimeter; in = inch; psf = pounds per square foot

The median particle size, D_{50}, of the existing streambed material is approximately 3 inches and has an incipient motion critical shear stress of approximately 1.2 pounds per square foot (psf). The 2-year recurrence interval flow for Methow River is estimated to be equal to the bankfull flow, therefore the D_{50} incipient motion critical shear stress was compared to the average shear stress of the new side channel during the 2-year recurrence interval. Hydraulic modeling computations indicate an average shear stress of less than 1.0 psf occurs within the proposed side channel. Results of the analysis indicate that the existing streambed material is adequate for the average shear stress of the proposed side channel. If good alluvium is not encountered within the side channel excavation, a streambed cobble is specified for backfill. The cobble with be washed with the streambed sediment to seal the bed and reduce risk of flows going subsurface.

3.5 Summary of hydraulic modeling or analyses conducted and outcomes – implications relative to proposed design

Restoration designs requires a fundamental model to evaluate the hydraulic behavior of the existing reach system. A detailed two-dimensional model was generated utilizing GeoHECRAS (version 2.1.0.17007) coupled with AutoCAD Civil 3D (Civil 3D) 2018 as the primary software applications. GeoHECRAS combines GIS and HEC-RAS software into one user interface for efficient task management, while Civil 3D was used as the main engine behind surface generation. The existing surface was generated with the LiDAR and survey topographical data described in Section 3.2.1. The two data sets were merged together in Civil 3D to represent the existing conditions surface of the reach and was used in GeoHECRAS to create an existing condition base terrain for the hydraulic model.

The hydraulic model analysis included scenarios with flows at the time of survey and the 2- and 100-year recurrence intervals. As was done in the gage transfer analysis, Tetra Tech reviewed the gage recorded flow at the time of performing the survey and estimated a flow of 397 cfs. The 2- and 100-year recurrence intervals were evaluated using the peak flow values obtained from the gage transfer analysis for the reach and the regression analysis performed for the Methow River and Alder Creek described in Section 3.3 and match the values listed in Table 3-6. The FEMA 100-year flow value was included in the analysis to consider project no-rise and project risk, and for comparison against the gage transfer 100-year flow value results.

Model geometry includes the terrain generated from the surface created in Civil 3D, a two-dimensional grid covering the terrain extents, breaklines to define banks, terraces, roads, and existing site features, Manning's roughness values in the form of a two-dimensional land cover layer, and upstream, downstream and Alder Creek boundary conditions. The Geolocation feature within Civil 3D was used to overlay an aerial map on the project extents. Based on the landcover presented in the aerial, the Manning's roughness values selected for the reach are tabulated in Table 3-7.

Table 3-8. Manning's Roughness Values

Land Cover	Manning's n
Agriculture	0.035
Roadways	0.015
Forested	0.100
Channel	0.032

Boundary conditions were set for each terminus of the model, inflow at the upstream end representing the recurrence interval flow rate, and normal depth at the downstream end representing the energy slope measured at the end of the model. The boundary condition for Alder Creek was set as an inflow hydrograph representing the recurrence interval flow rate for the creek.

After entering the geometry and hydraulic parameter information, unsteady flow analysis was computed for the time of survey flow value to review geometry input parameters and model calibration. Edge of water survey points were reviewed against inundation extents for 397 cfs. Manning's roughness values were iteratively adjusted for the channel until inundation results matched the edge of water survey points, until a channel roughness value of 0.032 indicated an accurate match. Upon the completion of model calibration, unsteady flow analysis computations were computed for the remainder of the scenarios. Attachment B illustrates existing conditions modeled for inundation extents for the 2- and 100-year gage transfer flow values.

Using the existing conditions hydraulic model, depth, velocity and shear stress maps for the survey flow and the 2- and 100-year recurrence intervals were produced. The results are provided in Figure 3.4 for 2- and 100-year gage flows. A proposed condition model was developed that incorporated the proposed LWD structures and side channel excavations. The model was run at low flow conditions (397 cfs) to check perennial connection of the side channels and at higher flows (2-year and 100-year) for design and stability analyses. The proposed conditions hydraulic model results are provided in Appendix B.

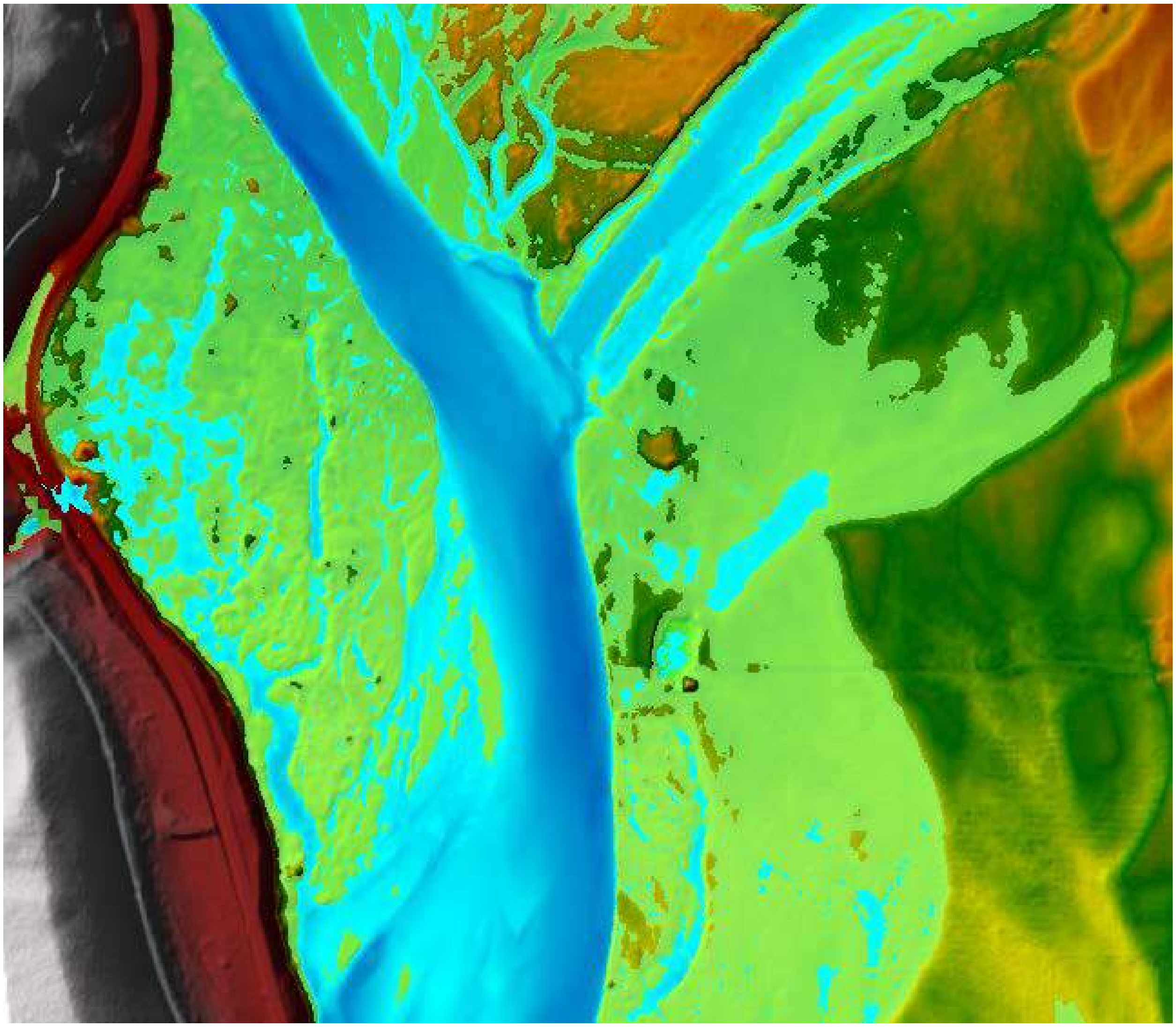

Figure 3-4. Existing Conditions Modeled Area for the Existing 2-Year (12,276 cfs, blue shades) and 100-Year (31,328 cfs, green shades) Gage Transfer Flow Values

3.5.1 Silver Side Channel

Water surface elevations were evaluated near the mouth of the Silver Side Channel for existing and proposed conditions at the 2-year flow. As shown in Figure 3-5, an approximately 400-feet long cross section was evaluated just upstream of the confluence of the Silver Side Channel and the Methow River. The existing conditions modeled water surface elevation was 1,475.0 feet, and the proposed conditions modeled water surface elevation was 1,474.8 feet. Results of the hydraulic evaluation are shown in Figure 3-6. This model includes only backwater flow from the Methow River into the Silver Side Channel, and does not incorporate

Silver Side Channel groundwater flow, thereby providing a conservative evaluation of the existing and proposed conditions at the confluence.

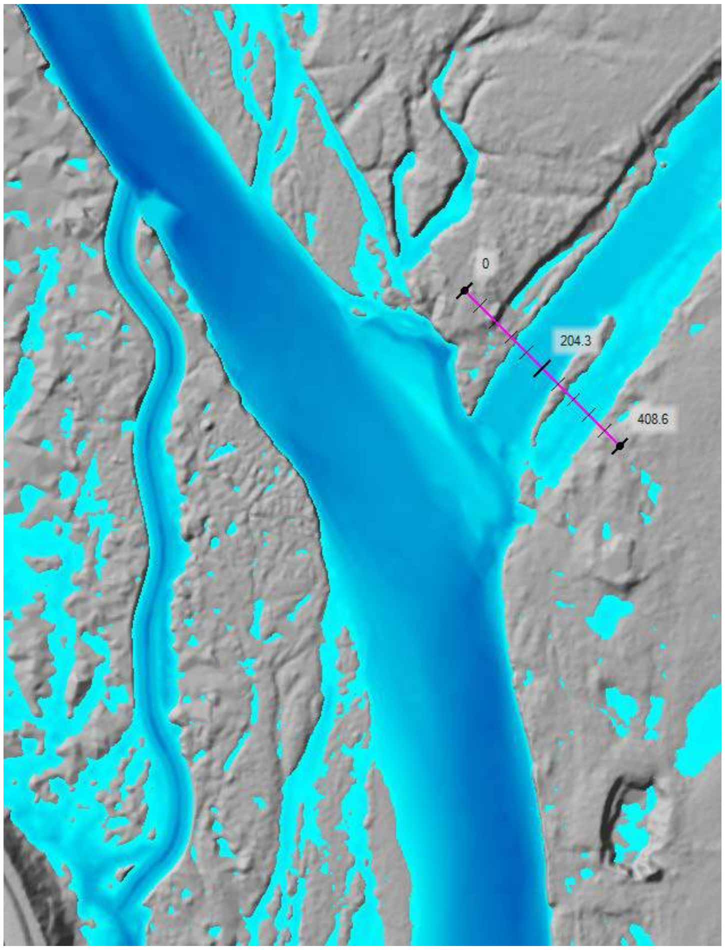

Figure 3-5. Hydraulic Cross Section (Purple Line) at Silver Side Channel Confluence at 2-Year Flow

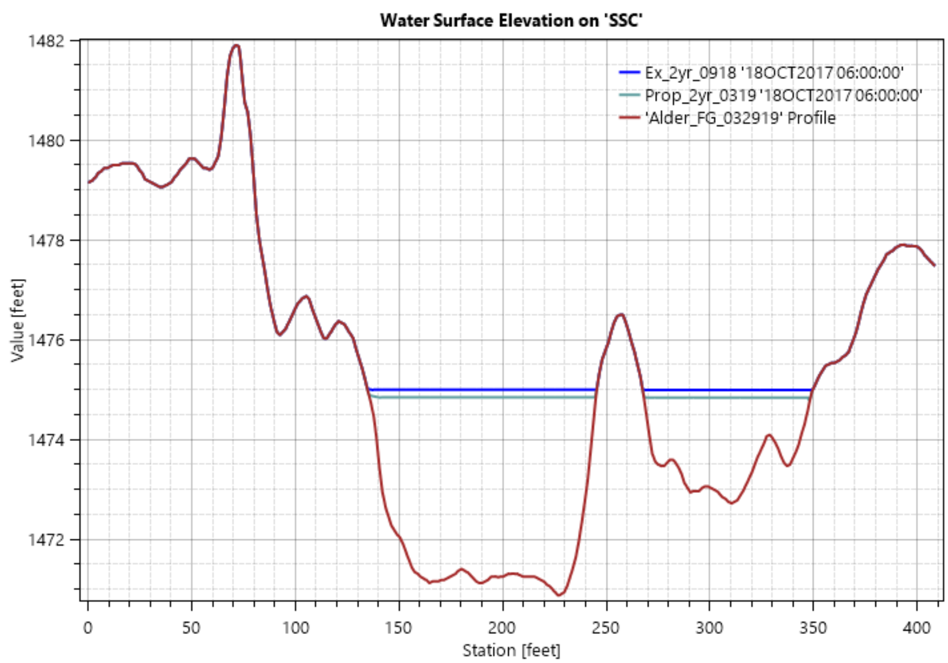

Figure 3-6. Existing and Proposed Water Surface Elevations at Silver Side Channel Confluence at 2-Year Flow

3.5.2 No-Rise Analysis

The FEMA effective 1D hydraulic model is currently not available. The FEMA flow was run under existing and proposed conditions using the 2D hydraulic model. The resulting water surface elevation grids were compared to display any estimated changes in the FEMA baseflood water surface. Appendix B includes this as Figure 16. The analysis shows that all changes are within plus or minus 0.5 feet. As discussed in the hydrology section, the FEMA flow value is not well defined for this reach so this may produce some uncertainty with the results. However, as discussed in the FEMA Region 10 Policy on Fish Enhancement Structures in the Floodway (FEMA 2009), the proposed actions were designed to keep any rise at a minimum while producing the desired benefit to the species of concern. The areas of rise of less than 0.5 feet do not impact any existing structures or infrastructure. The results so a slight decrease in water surfaces for the existing structures along the east bank of the Methow River.

3.6 Stability analyses and computations for project elements, and comprehensive project plan

The proposed side channel were evaluated at the proposed design event flows to evaluate element stability. The ballasted LWD structures were evaluated for stability against buoyancy and shear.

3.6.1 LWD Stability

A total of 37 LWD structures are proposed for the project within the main channel, Alder Creek, and the proposed side channel. These structures range from simple clusters of surface-placed structures, to complex log jams. The proposed LWD structures follow the BPA HIP III conservation measures for Category 2d (Install Habitat-Forming Natural Material Instream Structures [Large Wood, Boulders, and Spawning Gravel]). In addition, all proposed LWD structures have been designed to generally follow placement strategies and size requirements outlined in the Stream Habitat Restoration Guidelines (WSAHGP 2012), and the Large Woody Material – Risk Based Design Guidelines (USBR 2014).

All LWD structures have been designed for specific functions within the riverine ecosystem and are designed to withstand forces generated by the 100-year flood event while continuing to perform their intended function. The Log Jam Structure is being utilized at the inlet of the proposed side channel to assist in directing flow into this area. Additional LWD structures have been positioned throughout the project reach to assist in creating further instream habitat, including sediment deposition and pool formation. These structures are placed to interact with the channel bed and be partially mobile. The clusters of 2-log Cross Structures will be partially trenched in where they intersect the bank, bolted to vertical pilings, and contain significant portions of the large woody material outside of the active flow. The Bank Habitat Structures shall be backfilled in the side channel outside banks and intertwined with existing mature vegetation where available to provide additional resistance for drag and buoyancy forces.

Buoyancy

All LWD structures, including the Log Jam Structure, 2-Log Cross Structures, and Bank Habitat Structures have factor-of-safety (FOS) above 1 for buoyancy at the 100-year water surface elevation. Stability calculations for these structures, based on the standard force balance approach derived from D'Aoust and Millar (2000) coupled with the USBR USACE National Large Wood Manual (2016), are provided in the Large Woody Debris Stability Analysis Calculations (Appendix D). The structures are evaluated for a minimum FOS of 1.0 or greater.

Scour

General and pier scour were evaluated for the proposed LWD structures. The design of the Log Jam Structure and 2-log Cross Structure include vertical timber piles, either trenched or hammered in place, to keep the structure from sliding. The scour analysis was performed to design the embedment depth of the piles. Vertical timber piles for the 2-Log Cross are to be driven to a minimum embedment depth of 10', while the vertical timber piles for the Log Jam Structure are to be driven to a minimum embedment depth of 30'. The scour calculations for these structures, based on the USBR Computing Degradation and Local Scour (1984) and USACE Hydraulic Engineering Circular No. 18 (HEC-18) Evaluating Scour at Bridges (2012), are provided in the Large Woody Debris Stability Analysis Calculations (Appendix D). HEC-18 was used to evaluate the piles for the Log Jam Structure, as these piles will act like bridge piers within the water column. The bumper logs will be bolted to the vertical pilings using galvanized hardware as shown on the Design Drawings.

Sliding

All LWD structures, including the Log Jam, 2-Log Cross, and Bank Habitat Structures, have factor-of-safety (FOS) above 1.75 for sliding against the forces generated by the 100-year flood event. Siding calculations for these structures, based on the standard force balance approach derived from D'Aoust and Millar (2000) coupled with the USBR USACE National Large Wood Manual (2016), are provided in the Large Woody Debris Stability Analysis Calculations (Appendix D). The structures are evaluated for a minimum FOS of 1.75 or greater.

3.7 Description of how preceding technical analysis has been incorporated into and integrated with the construction – contract documentation

The contract documentation (i.e., design drawings, construction specifications) includes all relevant items from the preceding technical analyses.

3.8 For projects that address profile discontinuities (grade stabilization, small dam and structure removals): A longitudinal profile of the stream channel

thalweg for 20 channel widths upstream and downstream of the structure shall be used to determine the potential for channel degradation

This project does not address profile discontinuities.

3.9 For projects that address profile discontinuities (grade stabilization, small dam and structure removals): A minimum of three cross-sections – one downstream of the structure, one through the reservoir area upstream of the structure, and one upstream of the reservoir area outside of the influence of the structure) to characterize the channel morphology and quantify the stored sediment

This project does not address profile discontinuities.

4. CONSTRUCTION – CONTRACT DOCUMENTATION

4.1 Incorporation of HIP III general and construction conservation measures

Conservation measures will be included in the contract documentation for construction, and relevant items will be included in the design drawings, construction specifications, and implementation plan in later design stages. The overall design will be compliant with all HIP III activity conservation measures.

4.2 Design – construction plan set including but not limited to plan, profile, section and detail sheets that identify all project elements and construction activities of sufficient detail to govern competent execution of project bidding and implementation

The project plan sheets are attached as Appendix A.

4.3 List of all proposed project materials and quantities

Summary tables of materials and quantities are provided in Tables 4-1 (Structure Quantities) and 4-2 (Materials Quantities). Additional information about proposed project materials and quantities are provided in Appendix A, Appendix C, and the engineer's cost estimate (provided separately).

Table 4-1. Structure Quantities

Structure	Quantity
2-Log Cross Structure	21
Log Jam Structure	1
Riffle Cross Structure	2
Bank Habitat Structure	13

Table 4-2. Materials Quantities

Item	Size	Quantity
Logs with Rootwad	18 - 24 inch DBH, 40-foot minimum length	198
Logs without Rootwad	18 - 24 inch DBH, 40-foot minimum length	45
Pilings	12 - 18 inch DBH, 40-foot minimum length	9
Pilings	12 - 18 inch DBH, 15-foot minimum length	63

DBH – diameter at breast height

4.4 Description of best management practices that will be implemented and implementation resource plans including:

4.4.1 Site Access Staging and Sequencing Plan

The site access, staging, and sequencing plan is provided in Appendix A.

4.4.2 Work Area Isolation and Dewatering Plan

The site access, staging, and sequencing plan is provided in Appendix A.

4.4.3 Erosion and Pollution Control Plan

The site access, staging, and sequencing plan is provided in Appendix A.

4.4.4 Site Reclamation and Restoration Plan

The site access, staging, and sequencing plan is provided in Appendix A.

4.4.5 List Proposed Equipment and Fuels Management Plan

The site access, staging, and sequencing plan is provided in Appendix A.

4.5 Calendar schedule for construction/implementation procedures

A detailed construction schedule will be provided in the Final Construction Plans. A preliminary construction sequence to complete the project in a single year of construction is provided below.

Before in-water work window (prior to July 1):

- Complete pre-construction activities:
- Construction staking, flagging of sensitive areas, contractor submittals, etc.
- Mobilize to site and site preparation.
- Install temporary erosion and sediment controls (TESC).
- Acquisition, hauling, and staging of LWD.
- Excavate channel and floodplain above Ordinary High Water (OHW).

In-water work window (typically July 1 to July 31, may be later with regulatory agency approval):

- Install block nets and salvage fish (work to be completed by Yakama Nation Fisheries).
- Install and monitor TESC.

- Install work area isolation and dewater work areas.
- Construct channel and floodplain below OHW.
- Install LWD.
- Prewash work areas and pump turbid water to an approved location and monitor for no turbid returns to the stream.
- Slowly reintroduce flow to the work areas, monitoring for turbidity.
- Remove work area isolation.
- Remove block nets.
- Remove TESC.

After in-water work window (August 1 to September 15):

- Complete any excavation remaining above OHW.
- Install riparian fencing.
- Seed and mulch all disturbed areas.
- Site clean-up and demobilization.
- Plant trees and shrubs in the fall.

4.6 Site or project specific monitoring to support pollution prevention and/or abatement

No site- or project-specific monitoring for pollution prevention and/or abatement will be required.

5. MONITORING AND ADAPTIVE MANAGEMENT PLAN

If a Monitoring and Adaptive Management Plan is deemed necessary for this project, YNF will develop and submit as required.

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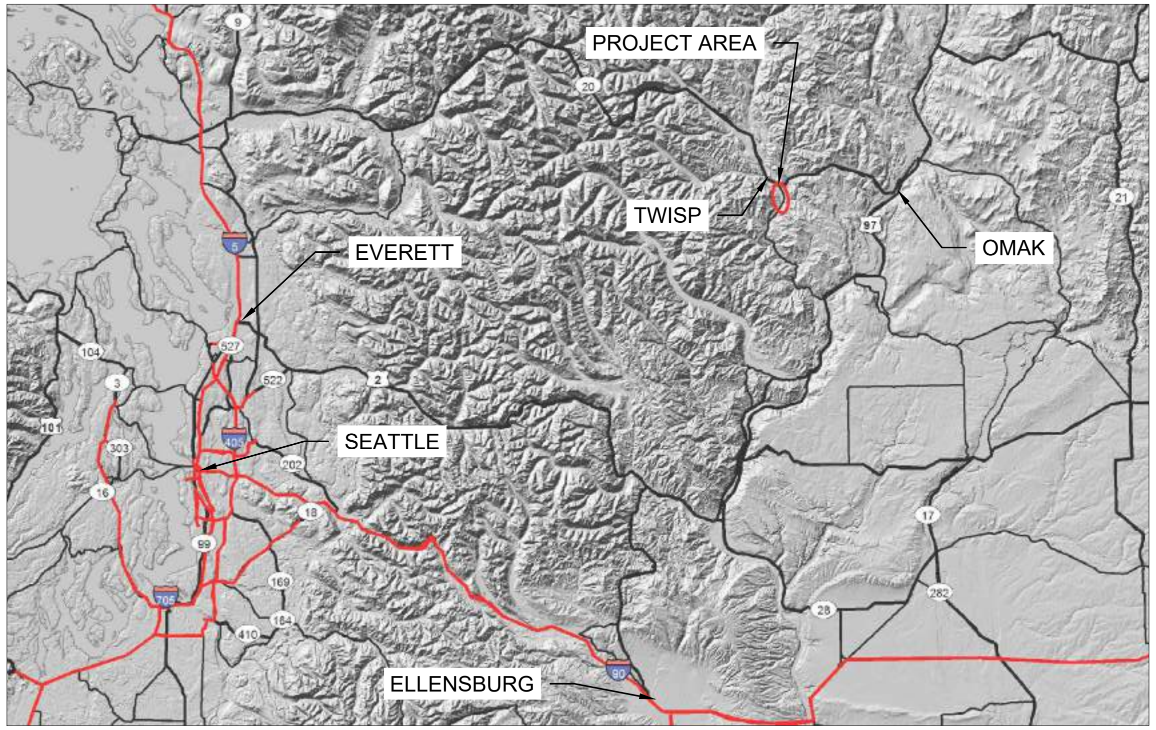
APPENDIX A

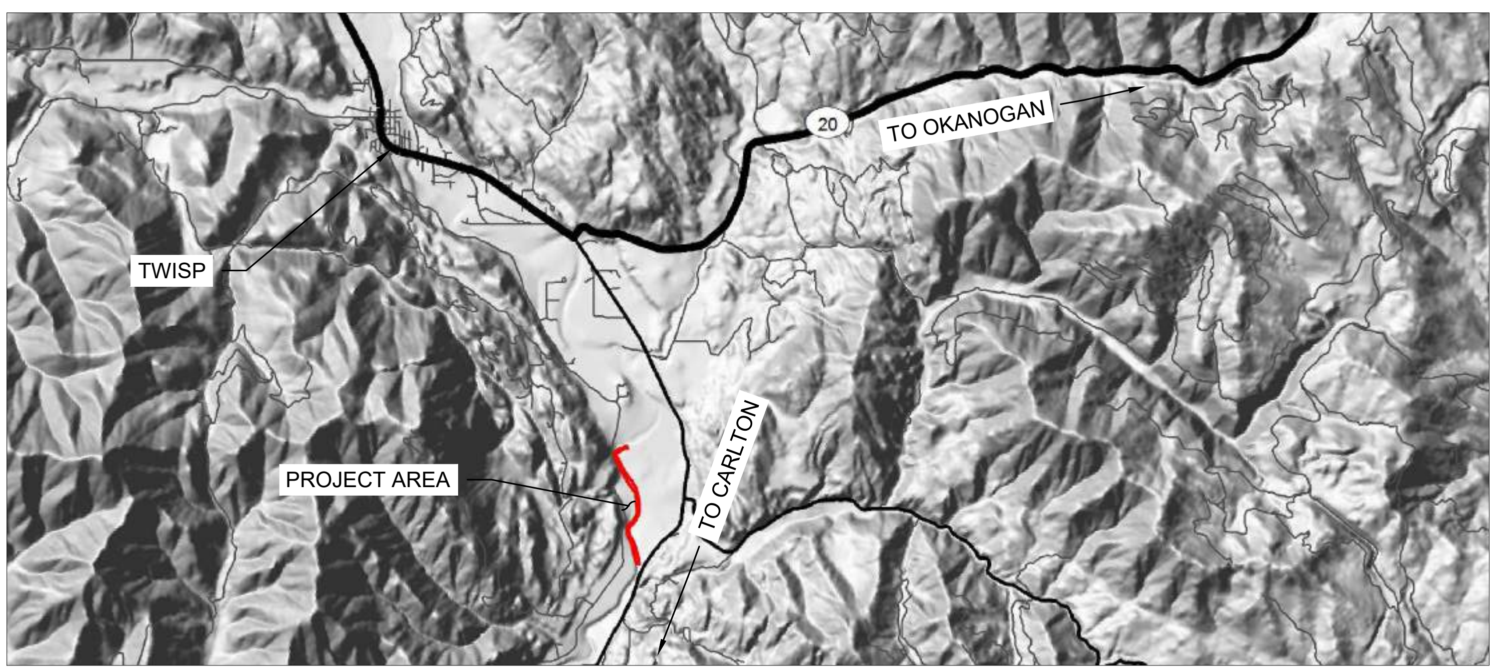
Project Plan Sheets

YAKAMA NATION FISHERIES
TWISP TO CARLTON REACH - ALDER CREEK FLOODPLAIN PROJECT
PERMIT LEVEL DESIGN PLAN



LOCATION MAP
SCALE: NTS

DRAWING INDEX	
DWG #	TITLE
	GENERAL
G-001	COVER SHEET
G-002	GENERAL NOTES
	CIVIL
E-001	EXISTING CONDITIONS
C-001	PROPOSED CONDITIONS OVERVIEW
C-101 - C-102	PROPOSED CONDITIONS
C-103 - C-104	PROPOSED SIDE CHANNEL DETAILS
C-201 - C-203	DETAILS - LWD CONSTRUCTION
C-301	DETAILS - TESC
C-302	DEWATERING AND REWATERING DETAILS
C-401 - C-403	SPECIAL PROVISIONS



VICINITY MAP
SCALE: 1" = 2 MILES

TETRA TECH
www.tetratech.com
19803 North Creek Parkway
Bothell, Washington 98011
Phone: 425-482-7600 Fax: 425-482-7652

Yakama Nation Fisheries

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PLOTTED AS ANSI B (11" X 17"), PLAN SHEET FULL SIZE ANSI D (22" X 34")

REV.	DATE	REVISION DESCRIPTION	DRW	ENG	CHK	APP
D	4/26/19	PERMIT LEVEL DESIGN	CEB	CEB	CM	JT
C	12/18/18	PERMIT LEVEL DESIGN	CEB	CEB	JA	JT
B	9/14/18	PERMIT LEVEL DESIGN	CEB	CEB	JA	JT
A	5/31/18	CONCEPT LEVEL DESIGN	CEB	CEB	JA	JT

YAKAMA NATION FISHERIES
TWISP TO CARLTON REACH
ALDER CREEK FLOODPLAIN PROJECT
PERMIT LEVEL DESIGN

COVER SHEET

DWG. NO.: G-001

CREATED: 12/11/2018

SHEET: 1 OF 17

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ABBREVIATIONS

1H:1V	HORIZONTAL TO VERTICAL EXAGGERATION
%	PERCENT
BPA	BONNEVILLE POWER ADMINISTRATION
DWG	DRAWING
EX.	EXISTING
FT, '	FOOT
IN, "	INCH
HIP	HABITAT IMPROVEMENT PROGRAM
LT, (L)	LEFT
LWD	LARGE WOODY DEBRIS
NTS	NOT TO SCALE
OHW	ORDINARY HIGH WATER
RD	ROAD
RM	RIVER MILE
RT, (R)	RIGHT
STA	STATION
TESC	TEMPORARY EROSION SEDIMENT CONTROL
TYP	TYPICAL
USGS	UNITED STATES GEOLOGICAL SURVEY
WDFW	WASHINGTON DEPARTMENT OF FISH AND WILDLIFE
XS	CROSS SECTION
YR	YEAR

RECOMMENDED CONSTRUCTION SEQUENCING:

1. PLACE TESC, WORK AREA ISOLATION, AND FISH SALVAGE MEASURES.
2. COMPLETE CLEARING AND GRUBBING.
3. EXCAVATE SIDE CHANNEL
4. INSTALL LWD STRUCTURES IN SIDE CHANNEL AND MAIN CHANNEL.
5. RESTORE AND RE-VEGETATE WORK AREAS.
6. REMOVES TESC, WORK AREA ISOLATION, AND FISH SALVAGE MEASURES.

GENERAL NOTES:

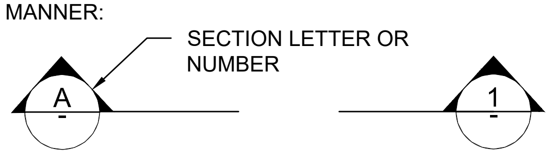
1. HORIZONTAL PROJECTION: NAD83 WASHINGTON STATE PLANES, NORTH ZONE, US FOOT.
2. VERTICAL PROJECTION: NAVD88.
3. PROJECT TOPOGRAPHIC SURFACE IS BASED ON 2015 LiDAR TOPOGRAPHIC DATA AND 2017 FIELD SURVEYS COMPLETED BY TETRA TECH IN OCTOBER 2017 AND 2018 FIELD SURVEYS COMPLETED BY TETRA TECH IN SEPTEMBER 2018.
4. PROJECT CHANNEL ALIGNMENT AND STATIONING IS BASED ON 2017 FIELD SURVEYS COMPLETED BY TETRA TECH IN OCTOBER 2017.
5. AERIAL IMAGERY USED IN THE PLANS ARE PROVIDED BY GOOGLE EARTH, 7/14/17.
6. PROPOSED PROJECT DESIGN, CONSTRUCTION ACTIVITIES, AND MATERIALS SUBJECT TO APPROVAL BY LANDOWNER.

GENERAL CONSTRUCTION NOTES:

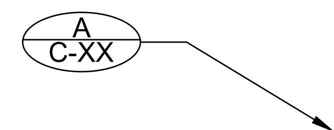
1. THE CONTRACTOR SHALL CONSTRUCT THE RESTORATION DESIGN ELEMENTS IN ACCORDANCE WITH THE PLANS STAMPED "ISSUED FOR CONSTRUCTION". THESE PLANS WILL BE PROVIDED TO THE CONTRACTOR BY THE CONTRACTING AGENCY PRIOR TO CONSTRUCTION. WORK SHALL NOT BE DONE WITHOUT THE CURRENT SET OF APPROVED CONSTRUCTION PLANS.
2. THE CONTRACTOR SHALL COMPLY WITH ALL APPLICABLE BPA HIP III TERMS AND CONDITIONS.
3. THE CONTRACTOR SHALL PURSUE WORK IN CONTINUOUS AND EFFICIENT MANNER TO ENSURE TIMELY COMPLETION OF THE PROJECT.
4. ALL WORK WITHIN THE ACTIVE CHANNEL SHALL ONLY OCCUR DURING PERMITTED IN WATER WORK WINDOW. USUALLY THIS OCCURS BETWEEN JULY 1 AND JULY 31, HOWEVER, IT MAY BE SHIFTED LATER DEPENDING ON PERMIT REQUIREMENTS.
5. ALL CONSTRUCTION ACTIVITIES SHALL MINIMIZE DISTURBANCE TO AND MAXIMIZE RE-USE OF EXISTING RIPARIAN VEGETATION.
6. THE CONTRACTOR SHALL PRESERVE AND PROTECT ALL MATURE TREES TO THE EXTENT POSSIBLE TO COMPLETE THE WORK.
7. THE CONTRACTOR SHALL PROTECT ALL CONTROL POINTS TO THE EXTENT PRACTICAL DURING CONSTRUCTION ACTIVITIES.
8. CONTRACTOR SHALL PROVIDE AN EROSION AND SEDIMENT CONTROL AND DEWATERING PLAN TO OWNER AT LEAST TEN (10) DAYS PRIOR TO THE BEGINNING OF CONSTRUCTION ACTIVITIES.

SYMBOLS

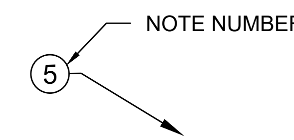
SECTIONS ARE REFERENCED IN THE FOLLOWING MANNER:



CONSTRUCTION DETAILS ARE REFERENCED IN THE FOLLOWING MANNER:



NOTES ARE REFERENCED IN THE FOLLOWING MANNER:



ALDER CREEK FLOODPLAIN PROJECT IMPACT SUMMARY

Construction Items	Units	22+00 to 38+00	Side Channel	Staging Area Cut	Spoils Repository
Cut	CY	1,332	16,043	1,380	0
Fill	CY	1,332	4,628	0	12,795
Large Wood (Rootwad)	EA	36	158	0	0
Large Wood (Logs)	EA	0	49	0	0
Piling	EA	54	9	0	0
Temporary Cofferdam	LF	0	172	0	0

Waterbody Impacts*	Units	22+00 to 38+00	Side Channel	Totals
OHW Cut Volume	CY	1,332	917	2,249
OHW Cut Area	SF	9,000	4,391	13,391
OHW Fill Volume	CY	1,332	740	2,072
OHW Fill Area	SF	9,000	2,000	11,000
OHW Fill LWD	CY	179	55	233
OHW Fill Boulder	CY	0	0	0
*CUT AND FILL QUANTITIES INCLUDE CUT AND FILL TOTALS AT AND BELOW OHW MARK				

Permament Wetland Impacts	Units	Wetland A	Wetland B	Wetland C	Wetland D	Wetland E	Wetland F	Wetland G	Wetland H	Totals
Wetland Dredge Volume	CY	1	0	863	0	0	0	181	125	1,170
Wetland Dredge Area	SF	33	0	8,469	0	0	0	1,626	1,688	11,816
Wetland Fill Volume	CY	0	0	0	0	0	0	0	0	0
Wetland Fill Area	SF	0	0	0	0	0	0	0	0	0

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19803 North Creek Parkway
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Yakama Nation Fisheries

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PLOTTED AS ANSI B (11" X 17"), PLAN SHEET FULL SIZE ANSI D (22" X 34")

REV.	DATE	REVISION DESCRIPTION	DRW	ENG	CHK	APP
D	4/26/19	PERMIT LEVEL DESIGN	CEB	CEB	CM	JT
C	12/18/18	PERMIT LEVEL DESIGN	CEB	CEB	JA	JT
B	9/14/18	PERMIT LEVEL DESIGN	CEB	CEB	JA	JT
A	5/31/18	CONCEPT LEVEL DESIGN	CEB	CEB	JA	JT

YAKAMA NATION FISHERIES
TWISP TO CARLTON REACH
ALDER CREEK FLOODPLAIN PROJECT
PERMIT LEVEL DESIGN

GENERAL NOTES

DWG. NO.: G-002

CREATED: 12/11/2018

SHEET: 2 OF 17

Z:\PROJECTS\194-6189 YNF_TWISP TO CARLTON\ALDER CREEK REACH\2 PERMIT DESIGN\SHEET FILES\ALDER CREEK FLOODPLAIN\01-COVER PAGE AND NOTES.DWG
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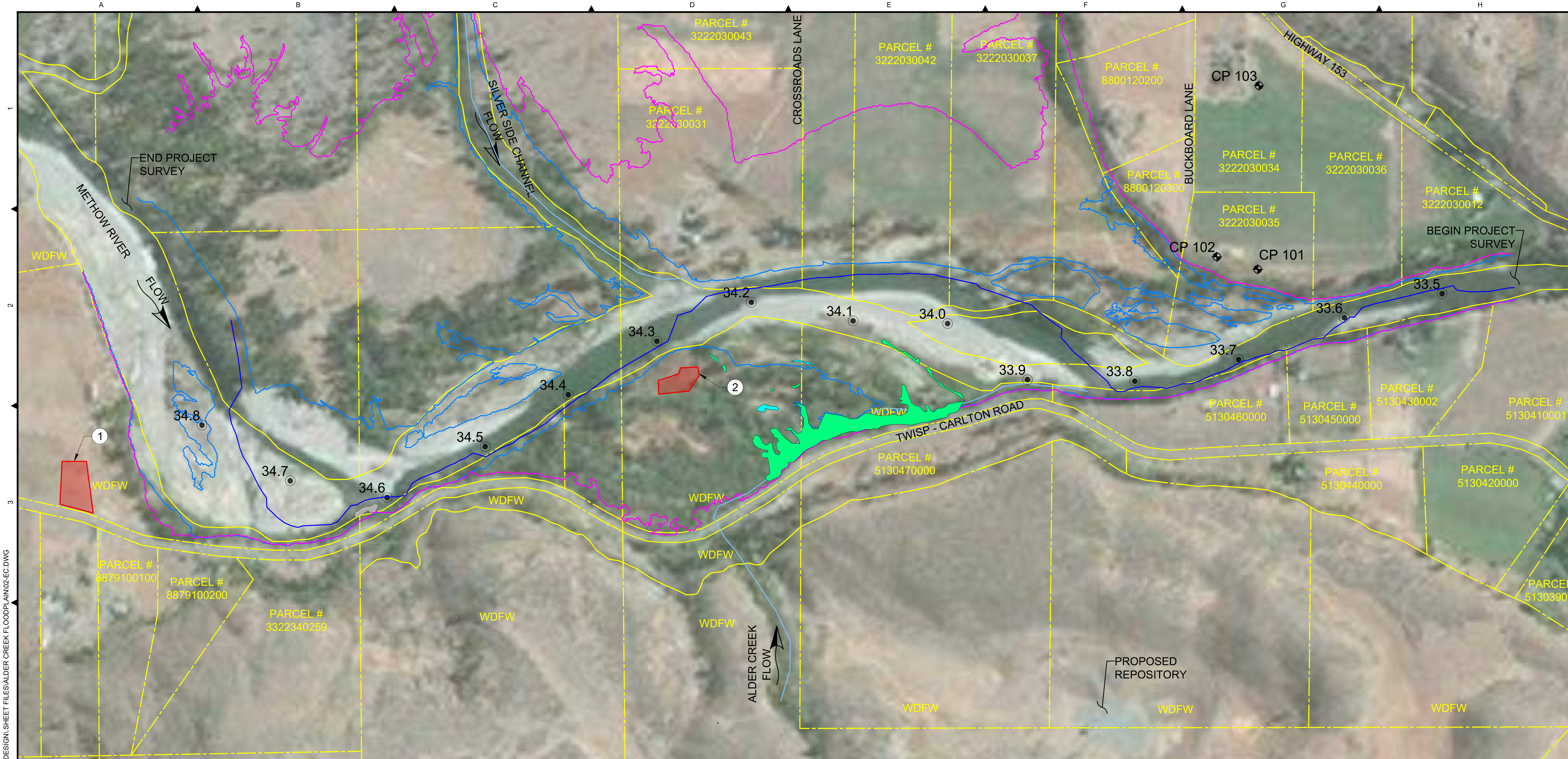

0' 250' 500' 1,000'

NOTES:

1. UPLAND STAGING AREA FOR EQUIPMENT AND REFUELING.
2. FLOODPLAIN STAGING AREA FOR LWD AND REFUELING .

CONTROL POINT TABLE

POINT #	NORTHING	EASTING	ELEVATION	DESCRIPTION
101	475074.19	1827704.68	1503.93	CP 101
102	475281.62	1827768.38	1509.72	CP 102
103	475067.48	1828637.14	1520.23	CP 103

LEGEND:

- METHOW RIVER THALWEG ALIGNMENT
- PROPERTY BOUNDARY
- EXISTING 100-YEAR INUNDATION (PROJECT MODEL)
- RIVER MILE (USGS)
- SURVEY CONTROL POINT
- EXISTING 2-YEAR INUNDATION (BANKFULL)
- EXISTING BEDROCK
- EXISTING TRIBUTARY (ALDER CREEK & SILVER SIDE CHANNEL)
- EXISTING CATEGORY II WETLAND
- EXISTING CATEGORY III WETLAND
- PROPOSED STAGING AREA

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Yakama Nation Fisheries

NOT FOR CONSTRUCTION

PLOTTED AS ANSI B (11" X 17"), PLAN SHEET FULL SIZE ANSI D (22" X 34")

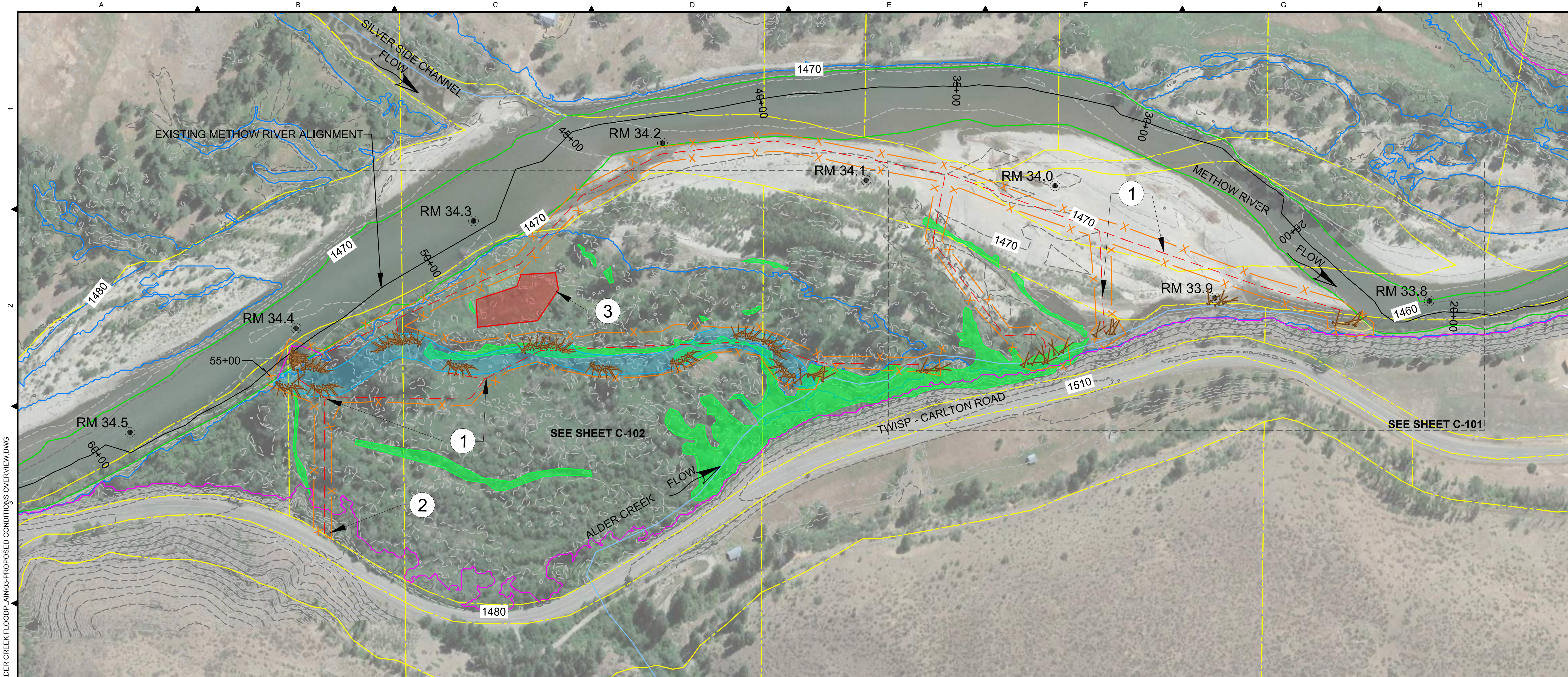
REV.	DATE	REVISION DESCRIPTION	DRW	ENG	CHK	APP
D	4/26/19	PERMIT LEVEL DESIGN	CEB	CEB	CM	JT
C	12/18/18	PERMIT LEVEL DESIGN	CEB	CEB	JA	JT
B	9/14/18	PERMIT LEVEL DESIGN	CEB	CEB	JA	JT
A	5/31/18	CONCEPT LEVEL DESIGN	CEB	CEB	JA	JT

YAKAMA NATION FISHERIES
TWISP TO CARLTON REACH
ALDER CREEK FLOODPLAIN PROJECT
PERMIT LEVEL DESIGN

EXISTING CONDITIONS

DWG. NO.: E-001
CREATED: 12/11/2018
SHEET: 3 OF 17

Z:\PROJECTS\194-6189 YNF_TWISP TO CARLTON\ALDER CREEK REACH\2 PERMIT DESIGN\SHEET FILES\ALDER CREEK FLOODPLAIN\02-EC.DWG
PLOT DETAILS: BAILEY, CHAD April 23, 2019 4:01 PM



0' 125' 250' 500'

NOTES:

1. POTENTIAL ACCESS ROUTE SHALL BE VERIFIED IN THE FIELD PRIOR TO CONSTRUCTION ACTIVITIES.
2. EXISTING ACCESS FROM TWISP-CARLTON ROAD WILL REQUIRE WIDENING TO ACCOMMODATE CONSTRUCTION EQUIPMENT AND HAUL TRUCKS.
3. STAGING FOR LWD MATERIALS AND EQUIPMENT STORAGE. DURING CLOSEOUT, STAGING AREA TO BE LOWERED APPROXIMATELY 2 FT AND RECLAIMED FOR DEVELOPMENT OF WETLAND MITIGATION. FINAL LOWERING TO BE CONFIRMED BASED ON SITE SPECIFIC CONDITIONS AT TIME OF CONSTRUCTION.

LEGEND:

- METHOW RIVER THALWEG ALIGNMENT
- PROPERTY BOUNDARY
- EXISTING 100-YEAR INUNDATION
- RIVER MILE
- SURVEY EOW
- EXISTING 2-YEAR INUNDATION (BANKFULL)
- ALDER CREEK AND SILVER SIDE CHANNEL
- SHEET BORDER
- EXISTING 10-FT MAJOR CONTOUR
- PROPOSED LWD STRUCTURES
- PROPOSED SIDE CHANNEL ENHANCEMENT
- PROPOSED ALCOVE ENHANCEMENT
- PROPOSED ACCESS ROUTE
- EXISTING WETLANDS
- PROPOSED TEMPORARY COFFERDAM
- PROPOSED STAGING AREA
- PROPOSED DISTURBANCE AREA

Z:\PROJECTS\194-6189 YNF_TWISP TO CARLTON\ALDER CREEK REACH\2 PERMIT DESIGN\SHEET FILES\ALDER CREEK FLOODPLAIN\03-PROPOSED CONDITIONS OVERVIEW.DWG
PLOT DETAILS: MCKINNEY, CHAD1 April 24, 2019 3:57 PM

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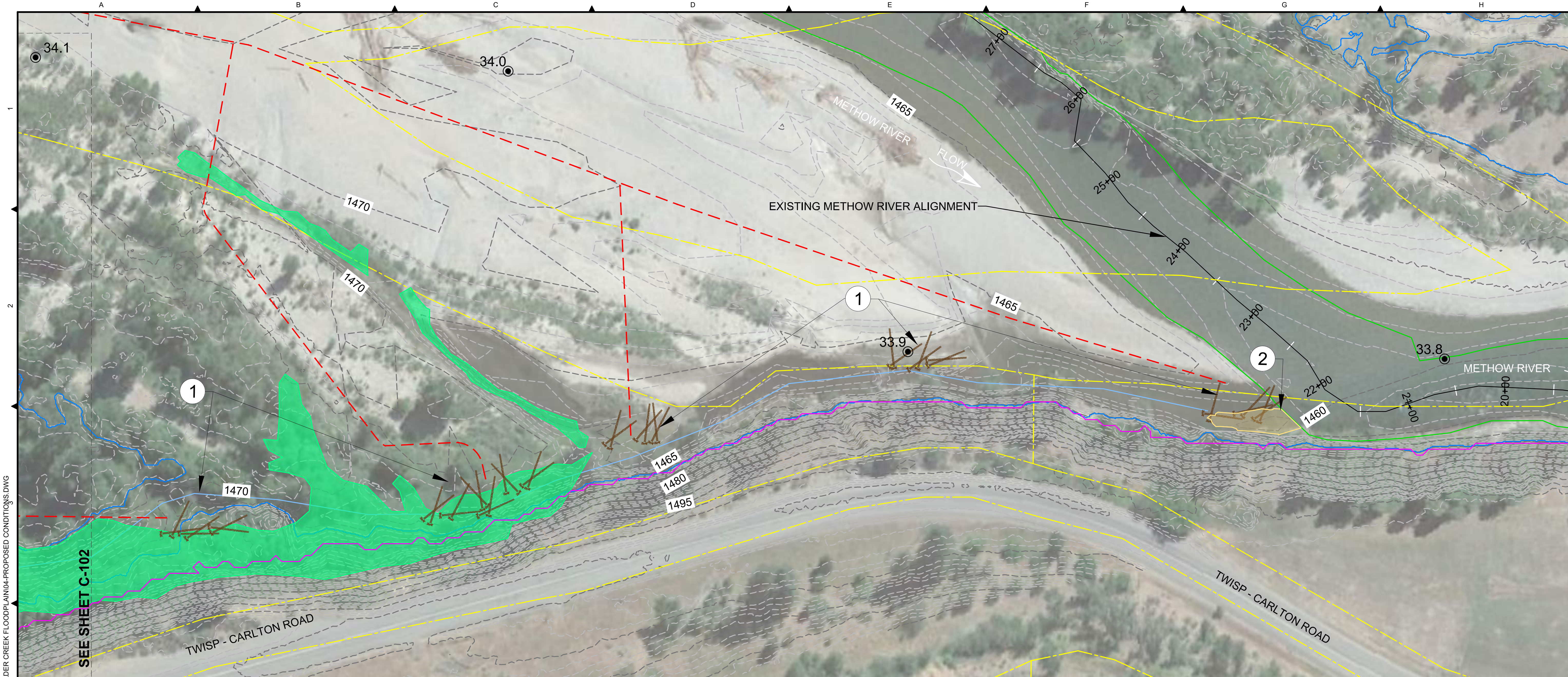
A	5/31/18	CONCEPT LEVEL DESIGN	CEB	CEB	JA	JT

YAKAMA NATION FISHERIES
TWISP TO CARLTON REACH
ALDER CREEK FLOODPLAIN PROJECT
PERMIT LEVEL DESIGN

PROPOSED CONDITIONS OVERVIEW

DWG. NO.: C-001
CREATED: 12/11/2018
SHEET: 4 OF 17



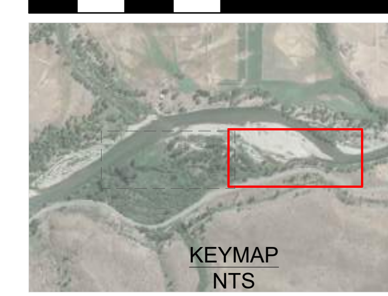
NOTES:

1. PLACE 2-LOG CROSS LWD FOR COVER AND INCREASED HABITAT COMPLEXITY IN ALDER CREEK/SIDE CHANNEL. FINAL LWD CONFIGURATION COORDINATION IN THE FIELD. SEE SHEET C-202 FOR TYPICAL DETAILS.
2. ENHANCE EXISTING ALCOVE AND ALDER CREEK OUTLET THROUGH PLACEMENT OF LWD STRUCTURES TO PROMOTE SCOUR AND PROVIDE COVER. LWD STRUCTURES TO BE COMBINATION OF 2-LOG CROSS, SEE SHEET C-202 FOR TYPICAL DETAILS.
3. SOME OF THE PROPOSED STRUCTURES WILL INCORPORATE EXISTING STRUCTURES. ALL LWD STRUCTURES TO BE FIELD FIT BASED ON CHANNEL CONDITIONS AT TIME OF CONSTRUCTION.

LEGEND:

- METHOW RIVER THALWEG ALIGNMENT
- PROPERTY BOUNDARY
- EXISTING 100-YEAR INUNDATION
- RIVER MILE
- SURVEY EOW
- EXISTING 2-YEAR INUNDATION (BANKFULL)
- ALDER CREEK AND SILVER SIDE CHANNEL
- SHEET BOUNDARY
- EXISTING 5-FT MAJOR CONTOUR
- PROPOSED LWD STRUCTURES
- PROPOSED SIDE CHANNEL
- PROPOSED ALCOVE ENHANCEMENT
- PROPOSED ACCESS ROUTE
- EXISTING WETLANDS
- PROPOSED TEMP. COFFERDAM
- PROPOSED STAGING AREA
- PROPOSED RIFFLE BOULDER

0' 50' 100' 200'



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Yakama Nation Fisheries

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REV.	DATE	REVISION DESCRIPTION	DRW	ENG	CHK	APP
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A	5/31/18	CONCEPT LEVEL DESIGN	CEB	CEB	JA	JT

YAKAMA NATION FISHERIES
TWISP TO CARLTON REACH
ALDER CREEK FLOODPLAIN PROJECT
PERMIT LEVEL DESIGN

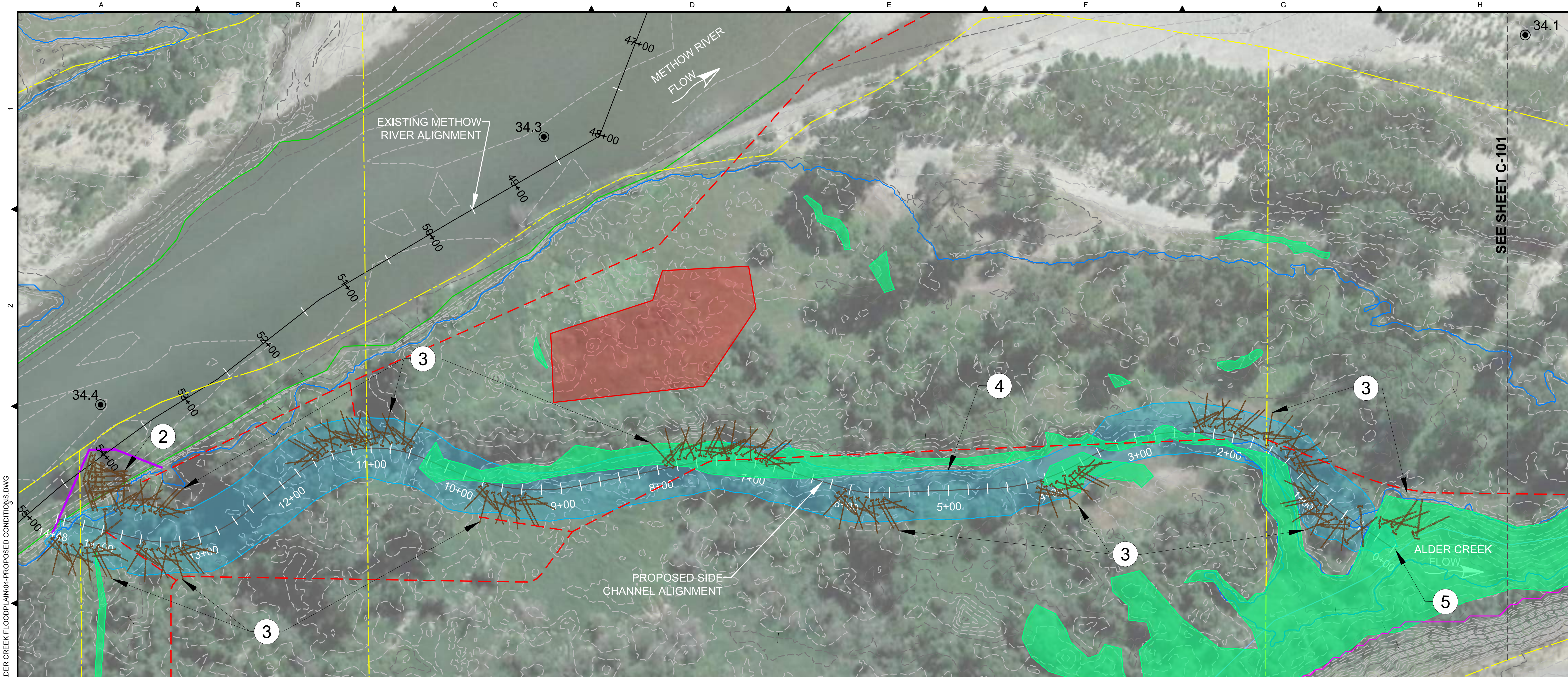
PROPOSED CONDITIONS

DWG. NO.: C-101

CREATED: 12/11/2018

SHEET: 5 OF 17

Z:\PROJECTS\194-6189 YNF_TWISP TO CARLTON\ALDER CREEK REACH\2 PERMIT DESIGN\SHEET FILES\ALDER CREEK FLOODPLAIN\04-PROPOSED CONDITIONS.DWG
PLOT DETAILS: BAILEY, CHAD May 1, 2019 10:59 AM



NOTES:

1. ADDITIONAL COFFERDAMS MAY BE NECESSARY AT TIME OF CONSTRUCTION DEPENDING ON FLOW AND RIVER ALIGNMENT.
2. INSTALL LOG JAM TO DIRECT FLOW INTO THE SIDE CHANNEL AND INCREASE CHANNEL COMPLEXITY. SEE SHEET C-201 FOR TYPICAL DETAILS.
3. PLACE BANK HABITAT LWD FOR COVER AND INCREASED HABITAT COMPLEXITY ON SIDE CHANNEL. FINAL LWD CONFIGURATION COORDINATION IN THE FIELD. SEE SHEET C-203 FOR TYPICAL DETAILS.
4. EXCAVATE FLOODPLAIN MATERIAL TO RECONNECT THE METHOW RIVER TO APPROXIMATELY 1,450 LINEAR FEET OF SIDE CHANNEL. SEE SHEET C-103 FOR DETAILS.
5. PROPOSED SIDE CHANNEL TO DISCHARGE TO EXISTING ALDER CREEK CHANNEL PRIOR TO DISCHARGING TO METHOW RIVER MAIN CHANNEL.
6. SOME OF THE PROPOSED STRUCTURES WILL INCORPORATE EXISTING STRUCTURES. ALL LWD STRUCTURES TO BE FIELD FIT BASED ON CHANNEL CONDITIONS AT TIME OF CONSTRUCTION.

LEGEND:

- METHOW RIVER THALWEG ALIGNMENT
- PROPERTY BOUNDARY
- EXISTING 100-YEAR INUNDATION
- RIVER MILE
- SURVEY EOW
- EXISTING 2-YEAR INUNDATION (BANKFULL)
- ALDER CREEK AND SILVER SIDE CHANNEL
- SHEET BOUNDARY
- EXISTING 5-FT MAJOR CONTOUR
- PROPOSED LWD STRUCTURES
- PROPOSED SIDE CHANNEL
- PROPOSED ALCOVE ENHANCEMENT
- PROPOSED ACCESS ROUTE
- EXISTING WETLANDS
- PROPOSED TEMP. COFFERDAM
- PROPOSED STAGING AREA
- PROPOSED RIFFLE BOULDER

0' 50' 100' 200'

KEYMAP
NTS

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Yakama Nation Fisheries

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C	12/18/18	PERMIT LEVEL DESIGN	CEB	CEB	JA	JT
B	9/14/18	PERMIT LEVEL DESIGN	CEB	CEB	JA	JT
A	5/31/18	CONCEPT LEVEL DESIGN	CEB	CEB	JA	JT

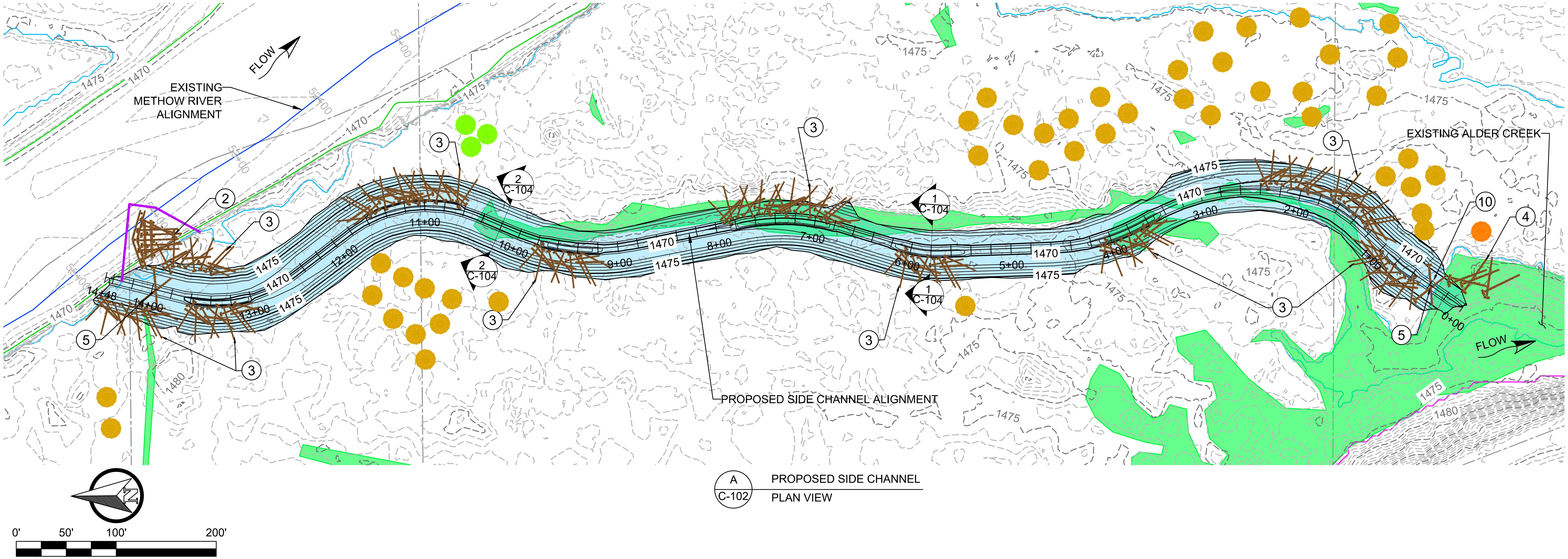
YAKAMA NATION FISHERIES
TWISP TO CARLTON REACH
ALDER CREEK FLOODPLAIN PROJECT
PERMIT LEVEL DESIGN

PROPOSED CONDITIONS

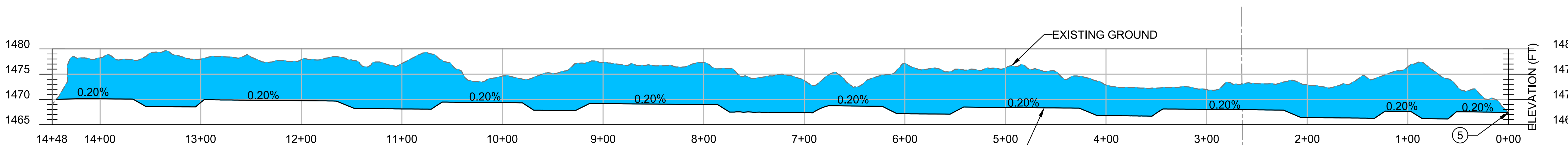
DWG. NO.: C-102

CREATED: 12/11/2018

SHEET: 6 OF 17



A C-102 PROPOSED SIDE CHANNEL PLAN VIEW



STREAM ALIGNMENT PROFILE VIEW (FT)
(SCALE 1" = 100', 1H:5V)

NOTES:

1. ADDITIONAL COFFERDAMS MAY BE NECESSARY AT TIME OF CONSTRUCTION DEPENDING ON FLOW AND ROVER ALIGNMENT.
2. INSTALL LOG JAM STRUCTURE PER DETAIL ON SHEET C-201.
3. INSTALL BANK HABITAT STRUCTURE PER DETAIL ON SHEET C-203.
4. PLACE LWD FOR COVER AND INCREASED HABITAT COMPLEXITY ON ALDER CREEK SIDE CHANNEL. FINAL LWD CONFIGURATION COORDINATION IN THE FIELD. SEE SHEET C-202 FOR TYPICAL DETAILS.
5. INSTALL LWD RIFFLE GRADE CONTROL. DETAIL TO BE PROVIDED AT NEXT DESIGN STAGE. LWD TO BE SLOPED BOTH HORIZONTALLY AND VERTICALLY. FINAL LOCATION OF LWD SHALL BE COORDINATED IN THE FIELD WITH OWNER'S REPRESENTATIVE.
6. DAYLIGHT CHANNEL GRADING TO EXISTING ALDER CREEK FIRM GRAVEL SURFACE BELOW BEAVER POND DEPOSITS. ELEVATION OF FIRM GRAVEL SURFACE SURVEYED 9-2018 AT APPROX. 1467.5 FT.
7. ADJUST CHANNEL ALIGNMENT TO AVOID EXISTING MATURE VEGETATION. MAINTAIN EXCAVATION OUTSIDE OF DRIPLINE OF MATURE TREES. CHANNEL ALIGNMENT TO BE FIELD VERIFIED PRIOR TO EXCAVATION.
8. SIDE CHANNEL EXCAVATION APPROX. 14,200 BCY.
9. SEE SHEET C-302 FOR SIDE CHANNEL DEWATERING AND REWATERING DETAILS.
10. PLACE EXCAVATED COARSE ALLUVIUM IN DOWNSTREAM CONSTRUCTED RIFFLE.

LEGEND:

- METHOW RIVER ALIGNMENT
- PROPERTY BOUNDARY
- EXISTING 100-YEAR INUNDATION
- SURVEY EOW
- EXISTING BANKFULL INUNDATION
- EXISTING CONTOUR MINOR - 1FT
- EXISTING CONTOUR MAJOR - 5FT
- EXISTING WETLANDS
- PROPOSED LWD STRUCTURES
- PROPOSED SIDE CHANNEL GRADING
- PROPOSED CONTOUR MINOR - 1FT
- PROPOSED CONTOUR MAJOR - 5FT
- PROPOSED TEMP. COFFERDAM
- EXISTING ALDERS - 18"+
- EXISTING COTTONWOODS - 18"+
- EXISTING BIRCH - 18"+

Z:\PROJECTS\194-6189 YNF_TWISP TO CARLTON\ALDER CREEK REACH\2 PERMIT DESIGN\SHEET FILES\ALDER CREEK FLOODPLAIN\05-SIDE CHANNELS.DWG
PLOT DETAILS: BAILEY, CHAD May 7, 2019 1:17 PM

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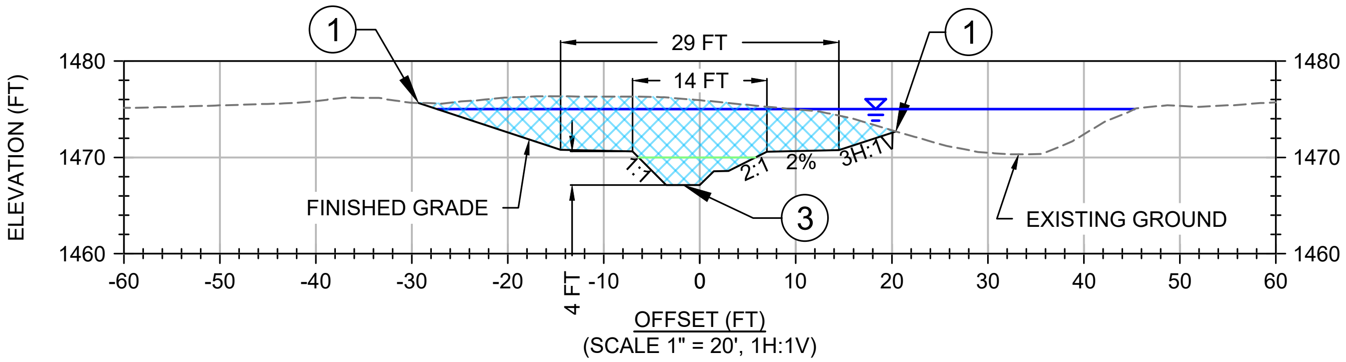
B	9/14/18	PERMIT LEVEL DESIGN	CEB	CEB	JA	JT
A	5/31/18	CONCEPT LEVEL DESIGN	CEB	CEB	JA	JT

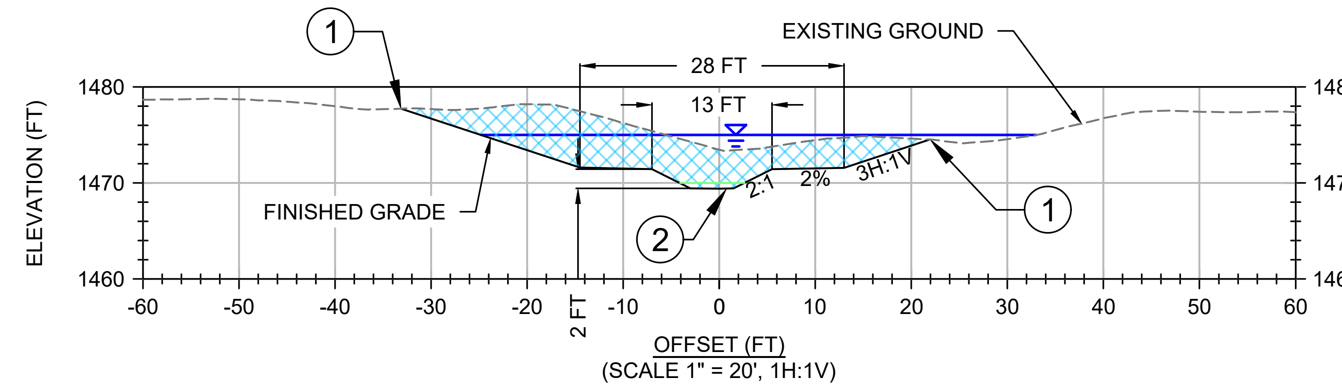
YAKAMA NATION FISHERIES
TWISP TO CARLTON REACH
ALDER CREEK FLOODPLAIN PROJECT
PERMIT LEVEL DESIGN

PROPOSED CONDITIONS
SIDE CHANNEL

DWG. NO.: C-103
CREATED: 12/11/2018
SHEET:



1 / C-103 POOL - SIDE CHANNEL
SECTION VIEW



2 / C-103 RIFFLE - SIDE CHANNEL
SECTION VIEW

NOTES:
1. DAYLIGHT PROPOSED CHANNEL AND FLOODPLAIN EXCAVATION TO MATCH EXISTING GRADE.
2. INSTALL LOW FLOW CHANNEL IN PROPOSED RIFFLES.
3. LOW FLOW EXCAVATION IN POOLS SHALL BE SHIFTED TO THE LEFT OR RIGHT TO MATCH UP WITH THE OUTSIDE OF THE PROPOSED MEANDER.

LEGEND:
- PROPOSED LWD STRUCTURES
- PROPOSED SIDE CHANNEL GRADING
- PROPOSED BANKFULL FLOW ELEVATION
- PROPOSED LOW FLOW ELEVATION

SIDE CHANNEL CONSTRUCTION POINT DATA

Point #	Elevation	Northing	Easting	Description

CONSTRUCTION POINT DATA PROVIDED AT FINAL DESIGN PHASE

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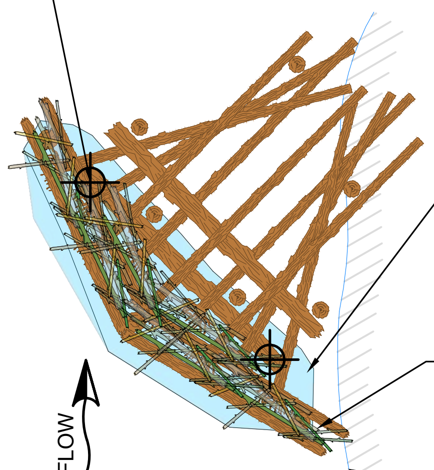
B	9/14/18	PERMIT LEVEL DESIGN	CEB	CEB	JA	JT
A	5/31/18	CONCEPT LEVEL DESIGN	CEB	CEB	JA	JT

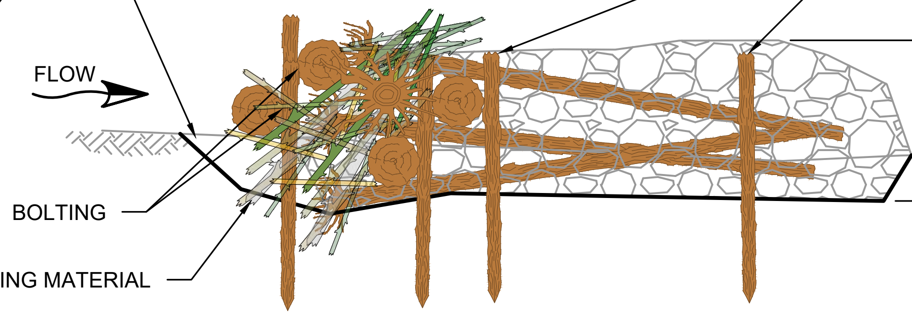
YAKAMA NATION FISHERIES
TWISP TO CARLTON REACH
ALDER CREEK FLOODPLAIN PROJECT
PERMIT LEVEL DESIGN

PROPOSED CONDITIONS
SIDE CHANNEL DETAILS

DWG. NO.: C-104
CREATED: 12/11/2018
SHEET: 8 OF 17



LOG JAM STRUCTURE - PLAN VIEWS



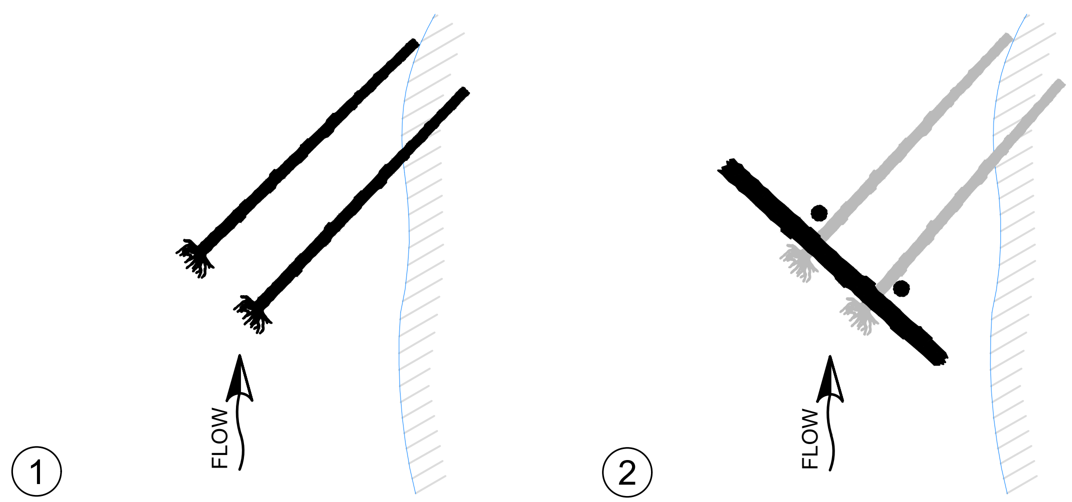
LOG JAM STRUCTURE - SECTION VIEW

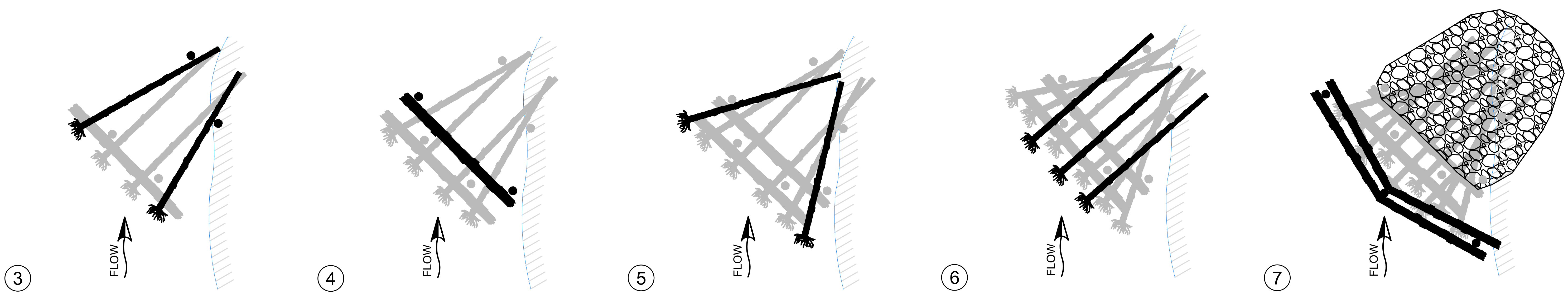
CONSTRUCTION QUANTITIES:

COMPONENT	DESCRIPTION	QUANTITY
LOG WITH ROOTWAD	18"+ DBH, 40 FT MIN	9
LOGS WITHOUT ROOTWAD	18"+ DBH, 40 FT MIN	6
VERTICAL PILING	12" - 18" DBH, 40 FT MIN	9
BALLAST	SPOILS/FLOODPLAIN ALLUVIUM	290 CY

LOG JAM STRUCTURE NOTES:

1. INSTALL TEMPORARY COFFERDAM TO ISOLATE WORK AREA.
2. FISH SALVAGE TO BE SUPERVISED BY QUALIFIED FISH BIOLOGIST.
3. EXCAVATE TRENCH A MINIMUM OF 3 FT TO COMPLETELY BURY BOTTOM LAYER OF STRUCTURE AND DEVELOP SCOUR POOL. EXCAVATE UPSTREAM PORTION OF TRENCH TO PROVIDE ELEVATED TIPS OF TREES IN SEQUENCE #1 WHEN ROOTWADS ARE PLACED IN TRENCH.
4. CONTRACTOR SHALL UTILIZE EXISTING LARGE TREES IDENTIFIED ONSITE AS DIRECTED BY OWNER.
5. PLACE TREES IN SEQUENCE #1. ROOTWADS PLACED IN DEEPEST PORTION OF POOL UPSTREAM.
6. LARGE BASE LOG PLACED IN SEQUENCE #2 DOES NOT REQUIRE ROOTWAD. PLACE LOG DOWNSTREAM OF SEQUENCE #1 ROOTWADS. PLACE VERTICAL PILINGS TO LOCK LARGE BASE LOG IN PLACE.
7. LOGS PLACED IN SEQUENCE #3 DO NOT HAVE BRANCHES. PLACE VERTICAL PILINGS AROUND PERIMETER OF SMALL LOGS TO LOCK IN PLACE.
8. LOGS PLACED IN SEQUENCE #4 THROUGH #6 SHALL BE PLACED AT BACK OF STRUCTURE AND PUSHED FORWARD INTO PLACE. LOGS TO BE INTERTWINED WITH PREVIOUSLY PLACED TREES AS MUCH AS POSSIBLE TO DEVELOP COMPLEX JAM. INSTALL VERTICAL PILINGS TO LOCK BASE LOG IN PLACE.
9. PLACE BUMPER LOGS AND PILES IN SEQUENCE #7 TO COVER AND PROTECT ANY EXPOSED ROOTWADS FOR RECREATIONAL BOATER SAFETY.
10. PILES SHALL BE DRIVEN TO A MINIMUM DEPTH OF 30' BELOW EXISTING STREAMBED.
11. BUMPER LOGS SHALL BE BOLTED TO VERTICAL PILINGS FOR ADDITIONAL STABILITY, SEE SHEET C-204 FOR TYPICAL DETAIL.
12. PLACE RACKING MATERIAL BEHIND BUMPER LOGS AND IN FRONT OF STRUCTURE TO PROMOTE A SEAL AT THE FACE OF THE JAM.
13. SPOILS FROM EXCAVATION SHALL BE USED TO BACKFILL STRUCTURE AS CONSTRUCTION PROGRESSES. MATERIAL SHALL BE COMPACTED WITH EXCAVATOR BUCKET. ADDITIONAL ALLUVIAL FLOODPLAIN MATERIAL MAY BE NEEDED TO BURY STRUCTURE AS SHOWN. BALLAST MATERIAL MAY BE HARVESTED FROM EXISTING EXPOSED GRAVEL BARS AS DIRECTED BY OWNER. BALLAST MATERIAL INCIDENTAL TO STRUCTURE COST.
14. PLANT 15 TO 25 WILLOW STAKES ABOVE RACKING AND BEHIND BUMPER LOGS TO COMPLETE CONSTRUCTION. CONTRACTOR SHALL BE RESPONSIBLE FOR PLANTING WILLOW STAKES.
15. FINAL CONFIGURATION OF STRUCTURE SHALL BE AS DIRECTED IN FIELD.





LOG JAM STRUCTURE - LOG PLACEMENT SEQUENCING

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Bothell, Washington 98011
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Yakama Nation Fisheries

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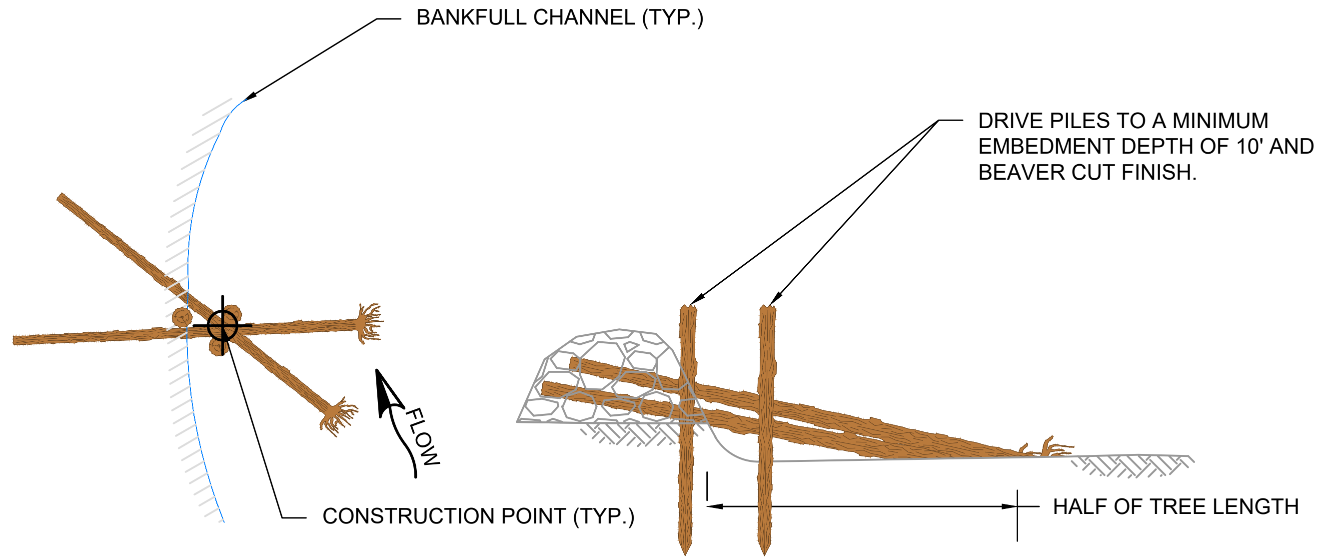
YAKAMA NATION FISHERIES
TWISP TO CARLTON REACH
ALDER CREEK FLOODPLAIN PROJECT
PERMIT LEVEL DESIGN

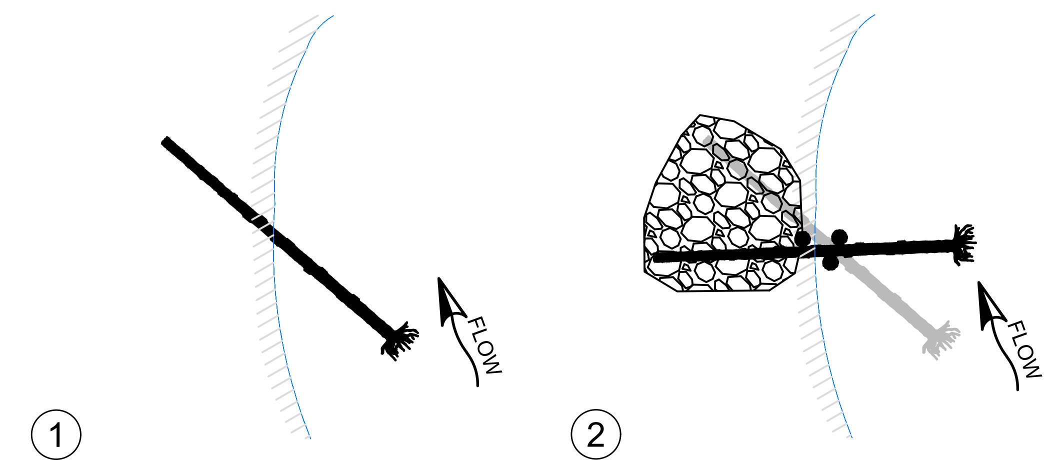
DETAILS
LWD CONSTRUCTION

DWG. NO.: C-201
CREATED: 12/11/2018
SHEET: 9 OF 17

Z:\PROJECTS\194-6189 YNF_TWISP TO CARLTON\ALDER CREEK REACH\2 PERMIT DESIGN\SHEET FILES\ALDER CREEK FLOODPLAIN\06-DETAILS_LWD.DWG
PLOT DETAILS: MCKINNEY, CHAD1 April 25, 2019 9:56 AM



2-LOG CROSS STRUCTURE WITH PILINGS - LEFT BANK PLAN AND SECTION VIEWS



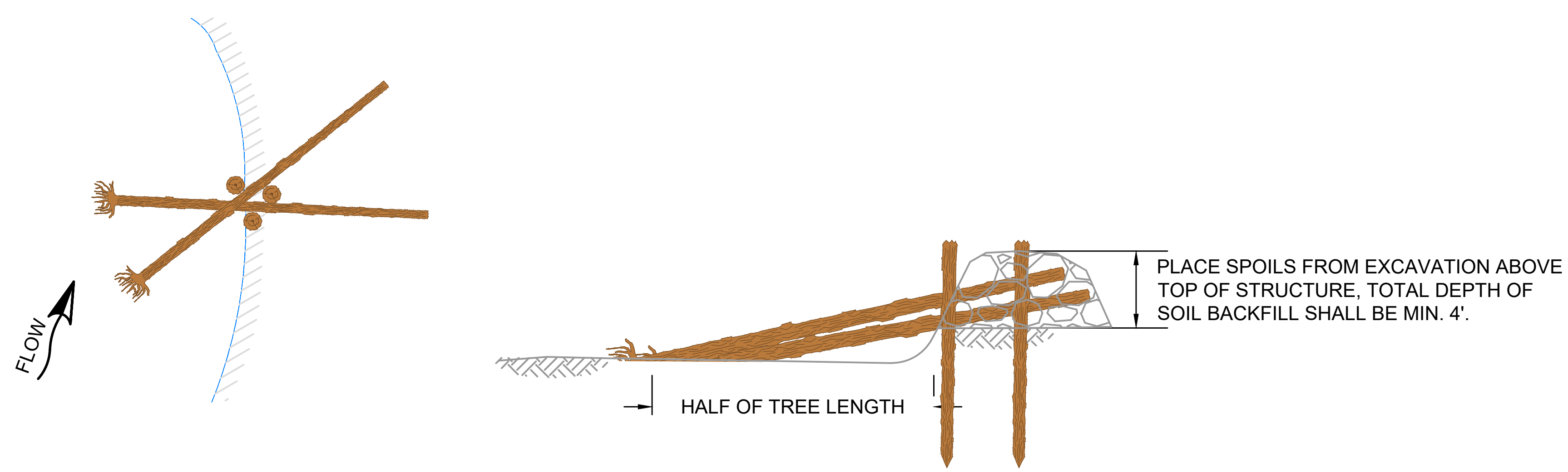
2-LOG CROSS STRUCTURE WITH PILINGS - LEFT BANK LOG PLACEMENT SEQUENCING

2-LOG CROSS STRUCTURE - STRUCTURE NOTES:

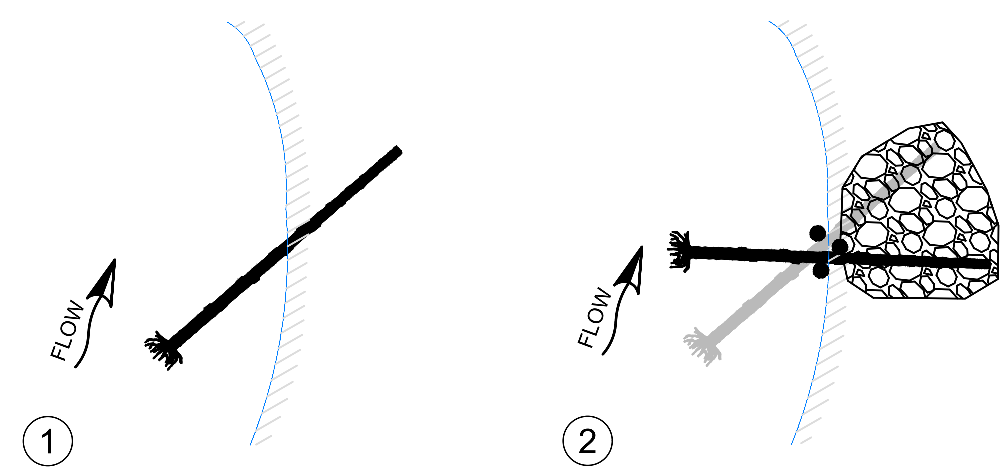
1. CONTRACTOR SHALL UTILIZE EXISTING LARGE TREES IDENTIFIED ONSITE AS DIRECTED BY OWNER.
2. PLACE HALF OF THE LENGTH OF THE LARGE LOG IN SEQUENCE #1 WITHIN BANKFULL CHANNEL WITH TIP OF LOG DOWNSTREAM OF STANDING TREE OR EXISTING BOULDER/BEDROCK, IF PRESENT.
3. BURY BOTTOM HALF OF SEQUENCE #1 ROOTWAD IN CHANNEL.
4. PLACE QUARTER TO HALF OF THE LENGTH OF THE LARGE LOG IN SEQUENCE #2 WITHIN BANKFULL CHANNEL WITH TIP OF LOG UPSTREAM OF STANDING TREE OR EXISTING BOULDER/BEDROCK, IF PRESENT.
5. BURY BOTTOM HALF OF SEQUENCE #2 ROOTWAD IN CHANNEL.
6. PLACE VERTICAL PILINGS ON EITHER SIDE OF LARGE LOGS TO LOCK IN PLACE. BOLT LARGE LOGS TO PILES PER DETAIL ON SHEET C-204.
7. SPOILS FROM EXCAVATION SHALL BE USED TO BACKFILL STRUCTURE AS CONSTRUCTION PROGRESSES. MATERIAL SHALL BE COMPACTED WITH EXCAVATOR BUCKET. ADDITIONAL ALLUVIAL FLOODPLAIN MATERIAL MAY BE NEEDED TO BURY STRUCTURE AS SHOWN. BALLAST MATERIAL MAY BE HARVESTED FROM EXISTING EXPOSED GRAVEL BARS AS DIRECTED BY OWNER. BALLAST MATERIAL INCIDENTAL TO STRUCTURE COST.
8. BANKFULL LOCATION WITH RESPECT TO STRUCTURE LOCATION IS A TYPICAL REPRESENTATION AND MAY VARY AT EACH STRUCTURE LOCATION. FINAL CONFIGURATION OF STRUCTURE SHALL BE AS DIRECTED IN FIELD.

CONSTRUCTION QUANTITIES:

COMPONENT	DESCRIPTION	QUANTITY
WHOLE LOG WITH ROOTWAD	18"+ DBH, 40 FT MIN	2
VERTICAL PILING	12" - 18" DBH, 15 FT MIN	3
BALLAST	SPOILS/FLOODPLAIN ALLUVIUM	75 CY



2-LOG CROSS STRUCTURE WITH PILINGS - RIGHT BANK PLAN AND SECTION VIEWS



2-LOG CROSS STRUCTURE WITH PILINGS - RIGHT BANK LOG PLACEMENT SEQUENCING

TETRA TECH
www.tetratech.com
19803 North Creek Parkway
Bothell, Washington 98011
Phone: 425-482-7600 Fax: 425-482-7652

Yakama Nation Fisheries

NOT FOR CONSTRUCTION

PLOTTED AS ANSI B (11" X 17"), PLAN SHEET FULL SIZE ANSI D (22" X 34")

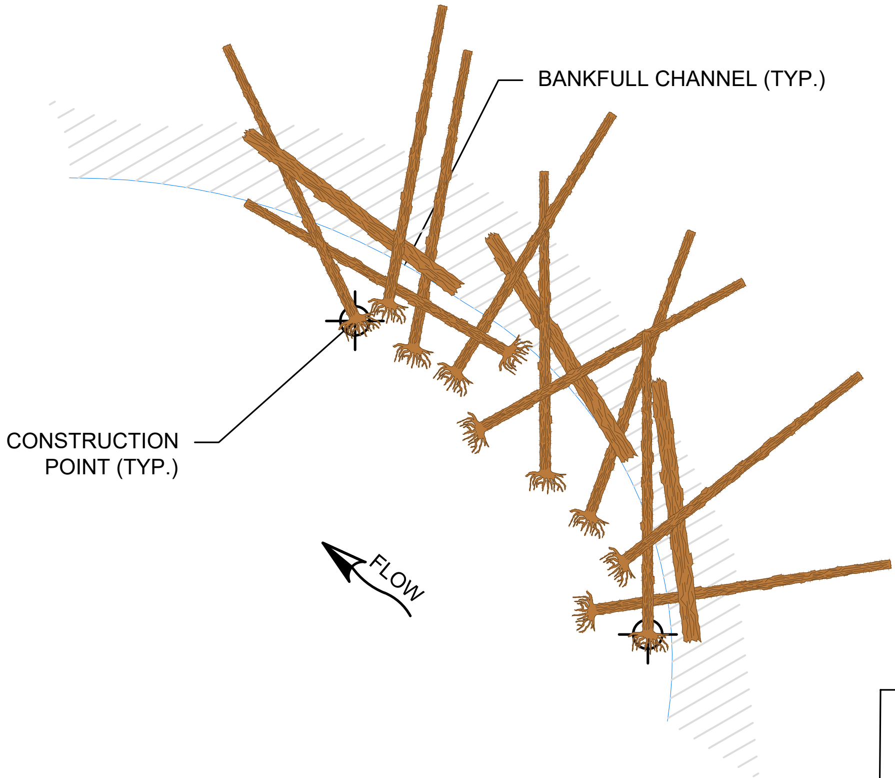
REV.	DATE	REVISION DESCRIPTION	DRW	ENG	CHK	APP
D	4/26/19	PERMIT LEVEL DESIGN	CEB	CEB	CM	JT
C	12/18/18	PERMIT LEVEL DESIGN	CEB	CEB	JA	JT
B	9/14/18	PERMIT LEVEL DESIGN	CEB	CEB	JA	JT
A	5/31/18	CONCEPT LEVEL DESIGN	CEB	CEB	JA	JT

YAKAMA NATION FISHERIES
TWISP TO CARLTON REACH
ALDER CREEK FLOODPLAIN PROJECT
PERMIT LEVEL DESIGN

DETAILS
LWD CONSTRUCTION

DWG. NO.: C-202
CREATED: 12/11/2018
SHEET: 10 OF 17

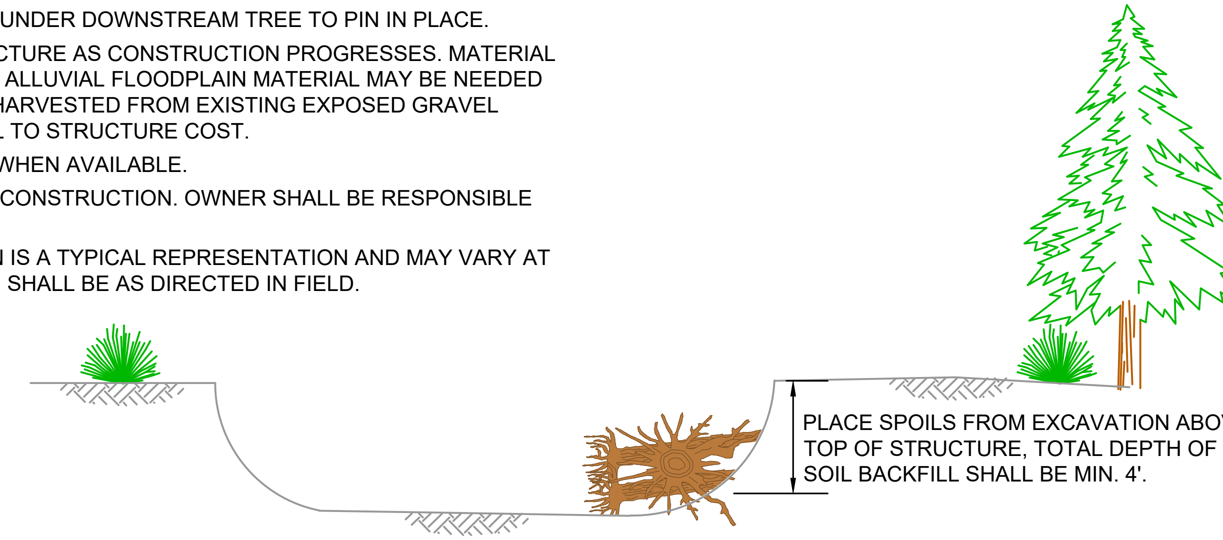
Z:\PROJECTS\194-6189 YNF_TWISP TO CARLTON\ALDER CREEK REACH\2 PERMIT DESIGN\SHEET FILES\ALDER CREEK FLOODPLAIN\06-DETAILS_LWD.DWG
PLOT DETAILS: BAILEY, CHAD April 25, 2019 12:33 PM



BANK HABITAT STRUCTURE - PLAN VIEW

LWD NOTES:

1. CONTRACTOR SHALL UTILIZE EXISTING LARGE TREES IDENTIFIED ONSITE AS DIRECTED BY OWNER.
2. PLACE TREES WITH ROOTWADS APPROX. 3 FT FROM BANK FACE. BURY STEMS OF TREES IN BANKS.
3. PLACE LOGS WITHOUT BRANCHES OVER UPSTREAM TREE AND UNDER DOWNSTREAM TREE TO PIN IN PLACE.
4. SPOILS FROM EXCAVATION SHALL BE USED TO BACKFILL STRUCTURE AS CONSTRUCTION PROGRESSES. MATERIAL SHALL BE COMPACTED WITH EXCAVATOR BUCKET. ADDITIONAL ALLUVIAL FLOODPLAIN MATERIAL MAY BE NEEDED TO BURY STRUCTURE AS SHOWN. BALLAST MATERIAL MAY BE HARVESTED FROM EXISTING EXPOSED GRAVEL BARS AS DIRECTED BY OWNER. BALLAST MATERIAL INCIDENTAL TO STRUCTURE COST.
5. RACKING MATERIAL MAY BE ADDED TO FRONT OF STRUCTURE WHEN AVAILABLE.
6. PLANT 15 TO 25 WILLOW STAKES IN STRUCTURE TO COMPLETE CONSTRUCTION. OWNER SHALL BE RESPONSIBLE FOR PLANTING WILLOW STAKES.
7. BANKFULL LOCATION WITH RESPECT TO STRUCTURE LOCATION IS A TYPICAL REPRESENTATION AND MAY VARY AT STRUCTURE LOCATION. FINAL CONFIGURATION OF STRUCTURE SHALL BE AS DIRECTED IN FIELD.



BANK HABITAT STRUCTURE - SECTION VIEW

CONSTRUCTION QUANTITIES:

COMPONENT	DESCRIPTION	QUANTITY
WHOLE TREE WITH ROOTWAD	MEDIUM (12" - 18" DBH, 35 FT MIN)	11
LOGS WITHOUT ROOTWAD	LARGE (18"+ DBH, 40 FT MIN)	3
BALLAST	SPOILS/FLOODPLAIN ALLUVIUM	282 CY

CONSTRUCTION SEQUENCE FOR BANK HABITAT STRUCTURE WILL BE PROVIDED AT THE NEXT DESIGN PHASE

BANK HABITAT STRUCTURE - LOG PLACEMENT SEQUENCING

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19803 North Creek Parkway
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Yakama Nation Fisheries

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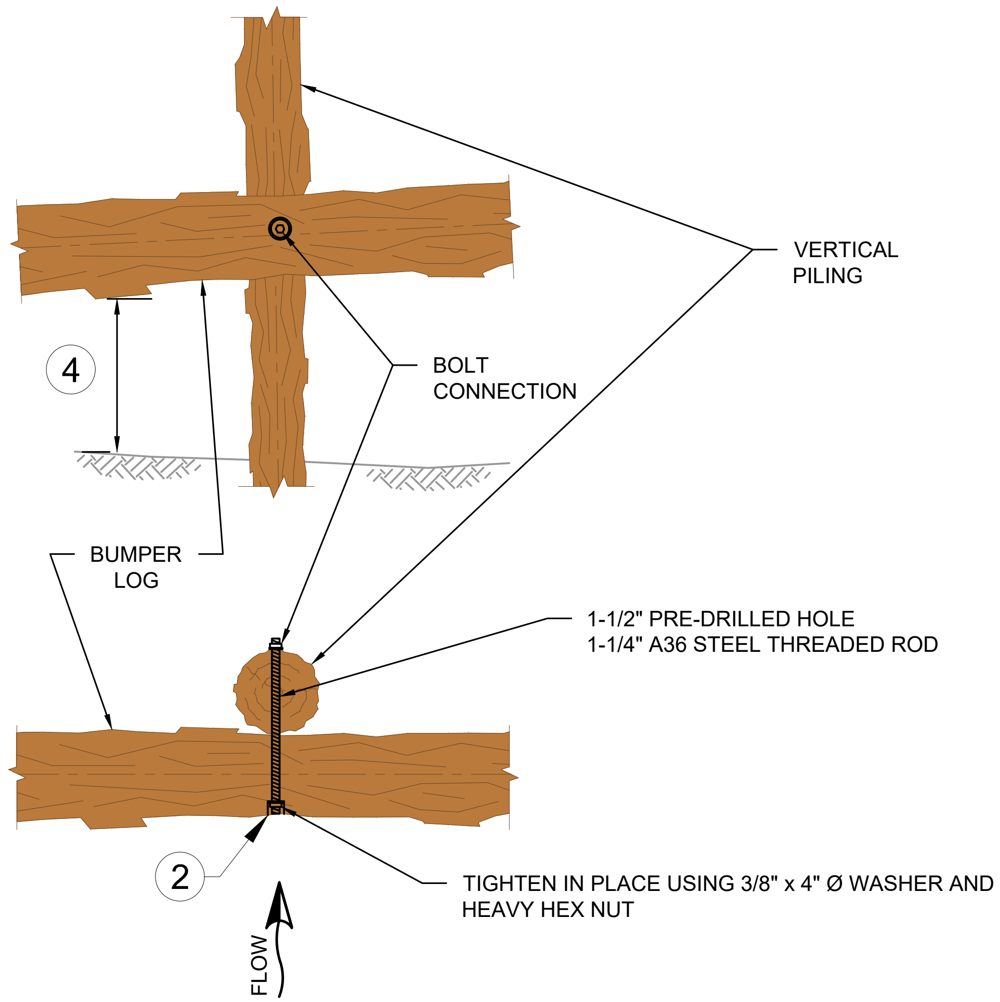
A	5/31/18	CONCEPT LEVEL DESIGN	CEB	CEB	JA	JT

YAKAMA NATION FISHERIES
TWISP TO CARLTON REACH
ALDER CREEK FLOODPLAIN PROJECT
PERMIT LEVEL DESIGN

DETAILS
LWD CONSTRUCTION

DWG. NO.: C-203
CREATED: 12/11/2018

Z:\PROJECTS\194-6189 YNF_TWISP TO CARLTON\ALDER CREEK REACH\2 PERMIT DESIGN\SHEET FILES\ALDER CREEK FLOODPLAIN\06-DETAILS_LWD.DWG
PLOT DETAILS: MCKINNEY, CHAD1 April 25, 2019 9:56 AM



LOG TO PILE BOLT CONNECTION TYPICAL DETAIL

NTS

BUMPER LOG CONNECTION NOTES:

1. CONNECTIONS SHALL BE GALVANIZED A36 STEEL AND BE MINIMUM 1-1/4" A36 THREADED STEEL RODS AND TIGHTENED WITH 3/8" X 4" Ø WASHERS AND HEAVY HEX NUTS.
2. CORE OUT A SLIGHTLY LARGER DIAMETER SECTION ON THE FACE OF THE BUMPER LOG TO COUNTERSINK THE WASHER, HEX NUT, AND PROJECTING THREADED ROD INTO THE WOOD FOR RECREATIONAL BOATER SAFETY.
3. SECURE NUTS BY CHISELING THREADS AND FILE OR GRIND OFF SHARP EDGES.
4. VERTICAL DISTANCE OF BUMPER LOGS FROM CHANNEL BOTTOM VARIES PER STRUCTURE. ORIENT FIRST AND SECOND BUMPER LOGS TO OVERLAP SLIGHTLY AND NOT CREATE A GAP BETWEEN THEM.
5. FINAL CONFIGURATION OF THE CONNECTIONS SHALL BE IN THE APPROXIMATE LOCATIONS AS SHOWN ON SHEETS C-201 AND C-203, AND AS APPROVED IN THE FIELD BY THE OWNER'S REPRESENTATIVE.

PILE TESTING NOTES:

1. CONTRACTOR SHALL PROVIDE TENSION SCALE, TENSION LINK, CHOKERS, CABLES, AND SHACKLES WITH A MINIMUM WORKING LOAD OF 12 TONS FOR TESTING THE PULL OUT RESISTANCE OF INSTALLED PILES. ALL FITTINGS SHALL BE SIZED ACCORDINGLY.
2. EQUIPMENT FOR PILE TESTING SHALL CONFORM TO THE TENSION SCALE PER THE MANUFACTURE'S RECOMMENDATIONS.
3. TESTING OF PILES SHALL BE PERFORMED WITH THE ENGINEER ONSITE.

PILE TESTING STEPS:

1. EACH PILE TEST SHALL HAVE UPWARD LOAD GRADUALLY INCREASED AS CLOSELY ALIGNED TO AXIS OF PILE. RECORD DIAMETER OF PILE, EMBEDMENT DEPTH, AND MAXIMUM FORCE REQUIRED TO LIFT THE PILE APPROXIMATELY 1" IN THE VERTICAL DIRECTION.
2. PERFORM THE TEST THREE ADDITIONAL TIMES DRIVING THE PILE TO A NEW DEPTH EACH TIME.
3. TEST EMBEDMENT DEPTHS SHALL BE DETERMINED BY THE ENGINEER AND MAY INCLUDE 8', 10', 12', 14', 16', AND 18'.
4. CONSTRUCTION EQUIPMENT UTILIZED FOR PILE TESTS SHALL KEEP A MINIMUM HORIZONTAL DISTANCE EQUAL TO THE EMBEDMENT DEPTH FROM THE PILE. IF A CLOSER POSITION IS REQUIRED, MAXIMIZE THE DISTANCE FROM PILE TO GENERATE DESIRED LOADING FOR THE TEST AND RECORD THE DISTANCE.
5. LIMIT GROUND DISTURBANCE AROUND THE PILE, PROVIDE LOG PLATFORM FOR CONSTRUCTION EQUIPMENT TO MAXIMIZE SURFACE AREA FOR GROUND LOAD DISTRIBUTION.
6. PULL OUT RESISTANCE SHALL BE COMPARED AGAINST EQUIPMENT MAX LIFT OFFSET TABLE.
7. 10% OF VERTICAL PILINGS SHALL BE TESTED. IF RESULTS VARY MORE THAT 50%, THEN INCREASE TESTING FREQUENCY TO 25% OF VERTICAL PILINGS.
8. DRIVEN PILE EMBEDMENT DEPTH SPECIFIED IN THE DRAWINGS MAY BE REDUCED OR INCREASED, PENDING TEST RESULTS AND ENCOUNTERED BEDROCK DEPTH, AT NO ADDITIONAL COST.

TETRA TECH
www.tetratech.com
19803 North Creek Parkway
Bothell, Washington 98011
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Yakama Nation Fisheries

NOT FOR CONSTRUCTION

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REV.	DATE	REVISION DESCRIPTION	DRW	ENG	CHK	APP
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A	5/31/18	CONCEPT LEVEL DESIGN	CEB	CEB	JA	JT

YAKAMA NATION FISHERIES
TWISP TO CARLTON REACH
ALDER CREEK FLOODPLAIN PROJECT
PERMIT LEVEL DESIGN

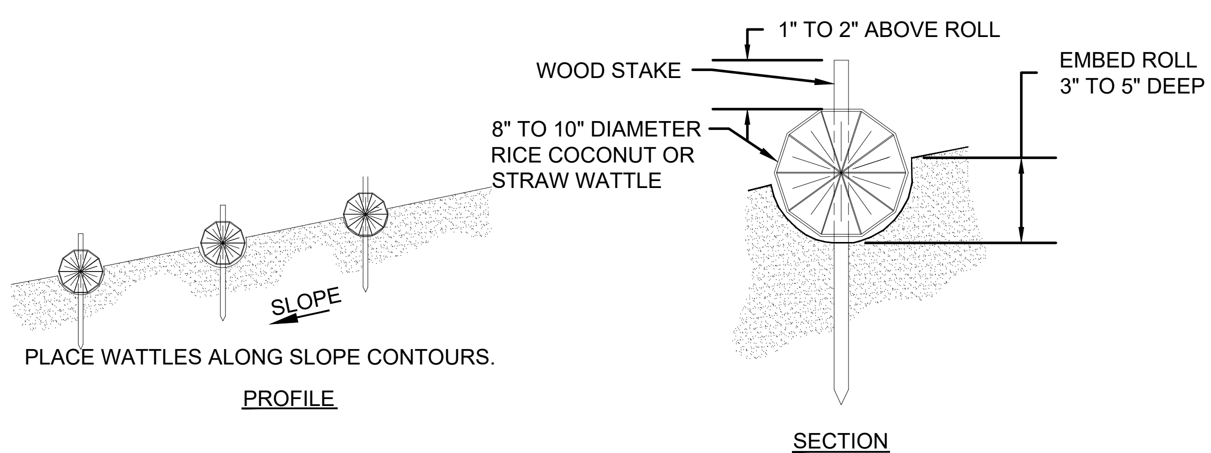
DETAILS

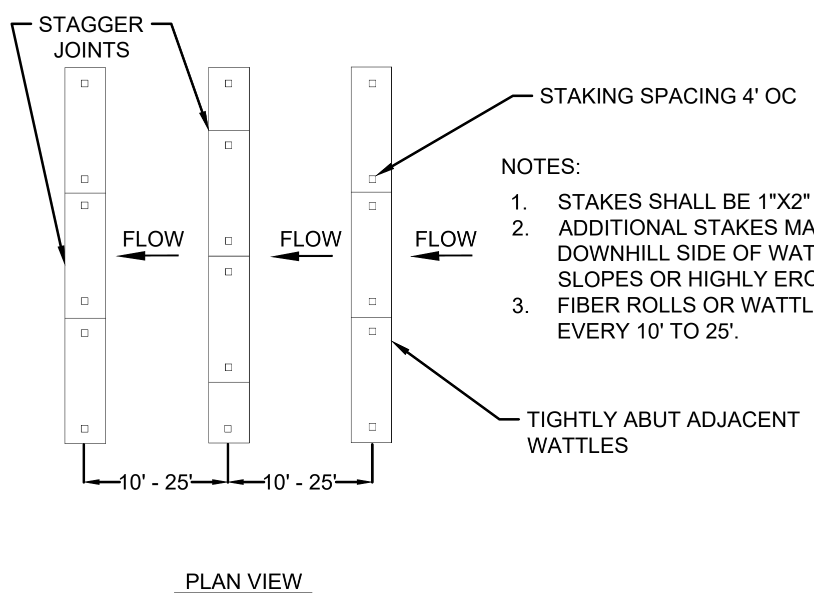
LWD CONSTRUCTION

DWG. NO.: C-204

CREATED: 12/11/2018

Z:\PROJECTS\194-6189 YNF_TWISP TO CARLTON\ALDER CREEK REACH\2 PERMIT DESIGN\.SHEET FILES\ALDER CREEK FLOODPLAIN\06-DETAILS_LWD.DWG
PLOT DETAILS: MCKINNEY, CHAD1 April 25, 2019 9:56 AM

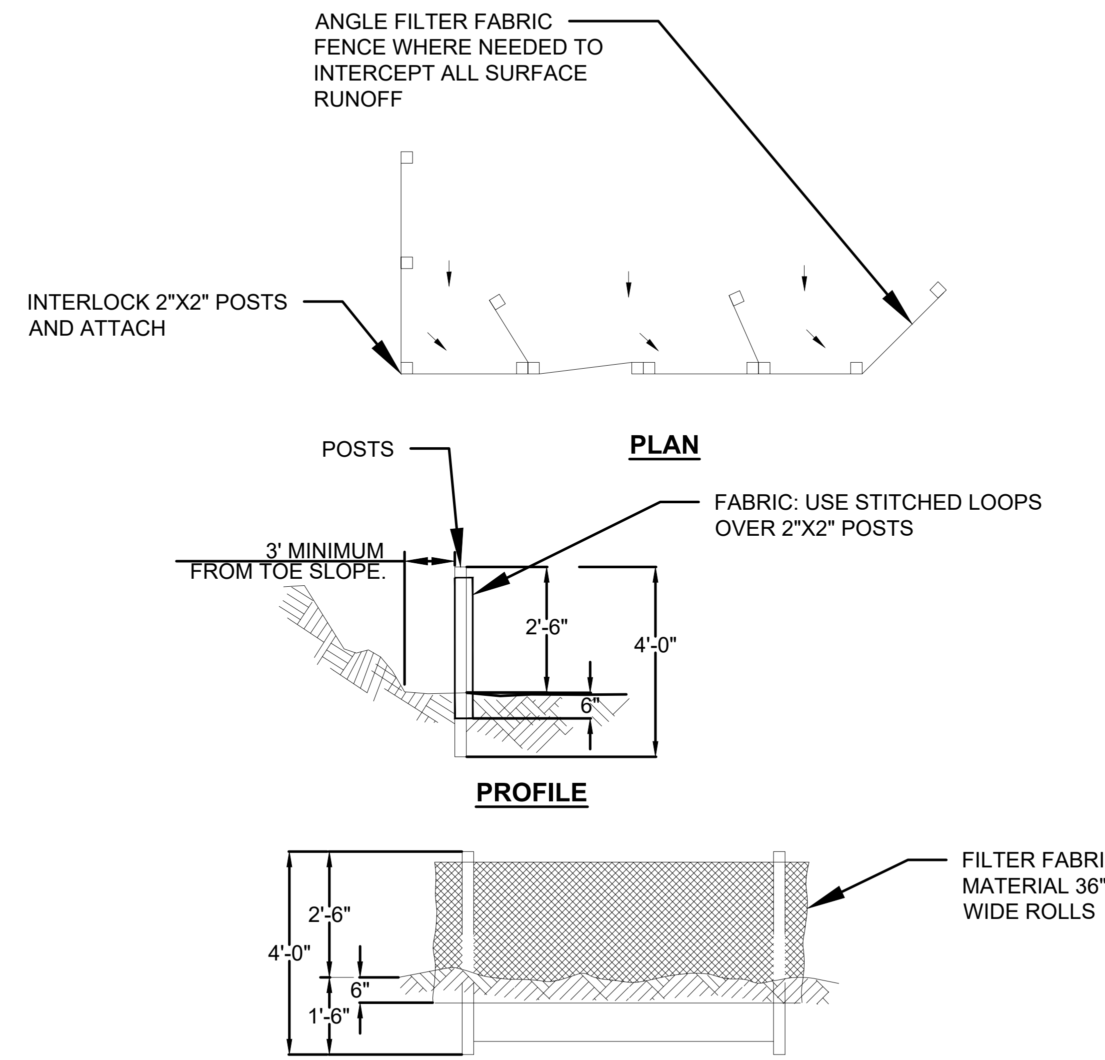




NOTES:

1. STAKES SHALL BE 1"X2" WOODEN STAKES.
2. ADDITIONAL STAKES MAY BE INSTALLED ON DOWNHILL SIDE OF WATTLES, ON STEEP SLOPES OR HIGHLY EROSIVE SOILS
3. FIBER ROLLS OR WATTLES TO BE INSTALLED EVERY 10' TO 25'.

FIBER ROLLS/WATTLES - TYPICAL DETAIL
NTS



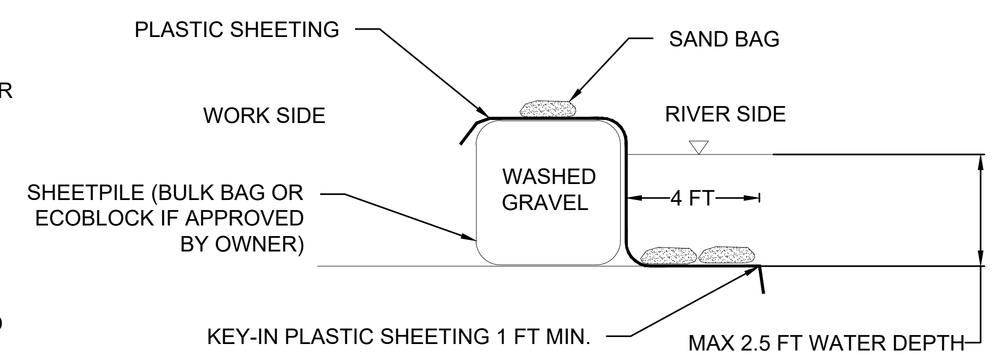
TEMPORARY SILT FENCE TYPICAL DETAIL
NTS

SEDIMENT FENCE NOTES:

1. SEDIMENT FENCE SHALL BE INSTALLED ON A LINE OF EQUAL ELEVATION.
2. BOTTOM EDGE OF SEDIMENT FENCE SHALL BE BURIED MIN 6".
3. POSTS MAY BE 2"X2" FIR, PINE OR STEEL.
4. POSTS TO BE INSTALLED ON UPHILL SIDE OF SLOPE.
5. COMPACT BOTH SIDES OF FILTER FABRIC TRENCH.
6. SEDIMENT SHALL BE REMOVED WHEN ACCUMULATION REACHES 1/3 OF THE MEASURE HEIGHT. SEDIMENT SHALL BE DISPOSED OF TO AN AREA THAT CAN BE PERMANENTLY STABILIZED.

COFFERDAM NOTES:

1. ALL WORK IN CHANNEL SHALL ONLY OCCUR DURING PERMITTED IN WATER WORK WINDOW. USUALLY THIS OCCURS BETWEEN JULY 1 AND JULY 31, HOWEVER, IT MAY BE SHIFTED LATER DEPENDING ON PERMIT REQUIREMENTS.
2. IN-WATER WORK AREAS SHALL BE ISOLATED BY COFFERDAMS.
3. ISOLATED AREAS REQUIRE FISH SALVAGE ACTIVITIES PRIOR TO THE INITIATION OF CONSTRUCTION.
4. FISH SALVAGE TO BE PERFORMED BY QUALIFIED FISH BIOLOGIST.
5. A TYPICAL STEEL SHEETPILE SYSTEM DRIVEN TO A DEPTH OF 10' SHOULD BE SUBSTITUTED FOR THE WASHED GRAVEL BULK BAG. FINAL DEPTH AND ORIENTATION OF THE SHEETPILE SYSTEM SHALL BE PROVIDED BY THE CONTRACTOR AND DESIGNED BY A GEOTECHNICAL ENGINEER.



TEMPORARY COFFERDAM SECTION TYPICAL DETAIL
NTS

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Bothell, Washington 98011
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Yakama Nation Fisheries

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YAKAMA NATION FISHERIES
TWISP TO CARLTON REACH
ALDER CREEK FLOODPLAIN PROJECT
PERMIT LEVEL DESIGN

DETAILS
TESC

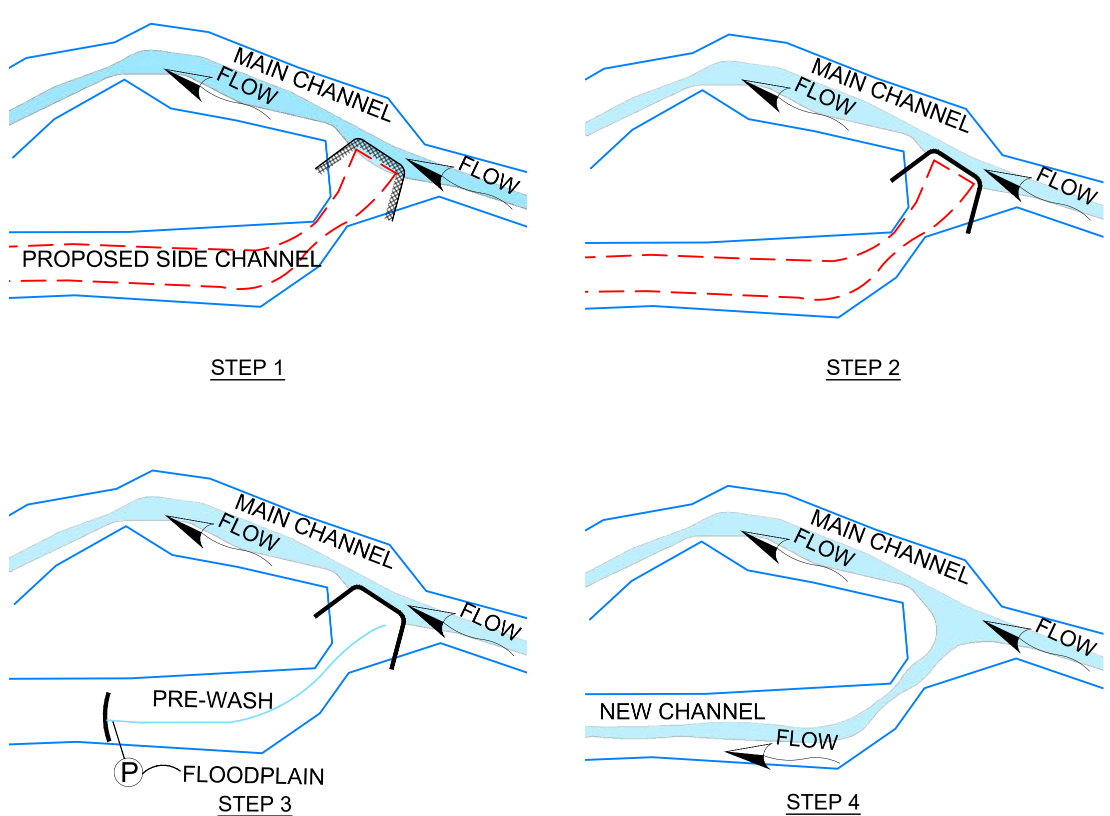
DWG. NO.: C-301
CREATED: 12/11/2018
SHEET: 13 OF 17

Z:\PROJECTS\194-6189 YNF_TWISP TO CARLTON\ALDER CREEK REACH\2 PERMIT DESIGN\SHEET FILES\ALDER CREEK FLOODPLAIN\06-DETAILS_LWD.DWG
PLOT DETAILS: MCKINNEY, CHAD1 April 25, 2019 9:56 AM

<u>RECOMMENDED DEWATERING AND REWATERING STEPS</u>

CONSTRUCTION SHALL OCCUR IN THE FOLLOWING GENERAL STEPS, WHICH CORRESPOND TO THE STEPS SHOWN ON THIS PLAN SHEET. ALL WORK WITHIN THE ACTIVE CHANNEL SHALL OCCUR WITHIN THE ALLOWABLE FISH WINDOW (JULY1 TO JULY 31).

1. INSTALL AND MAINTAIN TESC MEASURES. ESTABLISH WORK AREA ISOLATION AS SHOWN ON THIS SHEET.
2. DEWATERING AND INSTALLATION: INSTALL COFFERDAM AND DEWATER ISOLATED WORK AREA. EXCAVATE SIDE CHANNEL AND INSTALL INSTREAM HABITAT FEATURES AS SHOWN ON THE CONSTRUCTION PLAN SHEETS.
3. REWATERING: PERFORM STAGED REWATERING PROCESS WITH THE RECENTLY EXCAVATED CHANNEL. PREWASH EXCAVATED CHANNEL AND DETAIN AND RELEASE TURBID WATER TO THE FLOODPLAIN RATHER THAN FISH BEARING WATER. PREWASH CONSTRUCTED CHANNEL AND DETAIN AND RELEASE TURBID WATER TO THE FLOODPLAIN RATHER THAN FISH BEARING WATER. INSTALL SEINE AT UPSTREAM END OF CHANNEL TO PREVENT DOWNSTREAM FISH MOVEMENT UNTIL 2/3 OF TOTAL STREAMFLOW IS AVAILABLE IN THE CHANNEL. IN EARLY MORNING, INTRODUCE 1/3 OF FLOW INTO NEW CHANNEL OVER A 1-2 HOUR PERIOD. PERFORM TURBIDITY MONITORING PROTOCOL. INTRODUCE SECOND 1/3 OF THE FLOW OVER THE NEXT 1-2 HOURS. AFTER SECOND 1/3 IS INTRODUCED AND TURBIDITY IS WITHIN 10% OF THE BACKGROUND LEVEL, REMOVE SEINE NETS FROM THE NEW CHANNEL, AND ALLOW DOWNSTREAM FISH MOVEMENT.
4. SITE RESTORATION: STREAM BANKS AND DISTURBED AREA SHALL BE PERMANENTLY STABILIZED AS NECESSARY USING ONSITE NATIVE MATERIAL AND ALL PROJECT WASTE MATERIAL REMOVED.



SIDE CHANNEL EXCAVATION WITH LOCAL ISOLATION (TYP.)

(NTS)

<u>LEGEND:</u>

- TOP OF BANK
- LOW FLOW LINE
- FISH BLOCK NET
- EXCAVATION LIMITS
- COFFER DAM
- (P) PUMP
- LWD

<u>GENERAL FISH SALVAGE AND DEWATERING STEPS</u>

CONSTRUCTION SHALL OCCUR IN THE FOLLOWING GENERAL STEPS, WHICH CORRESPOND TO THE STEPS SHOWN ON THIS PLAN SHEET.

A) ISOLATION AND SALVAGE: ESTABLISH LIMITS OF EXCAVATION, STAGING AREAS AND ACCESS ROADS. INSTALL AND MAINTAIN EROSION AND SEDIMENT CONTROL MEASURES. INSTALL BLOCKNETS AND ESTABLISH WORK AREA ISOLATION AS SHOWN ON THIS SHEET. FISH SALVAGE METHODS SHALL BE IN ACCORDANCE WITH HIP III GUIDELINES.

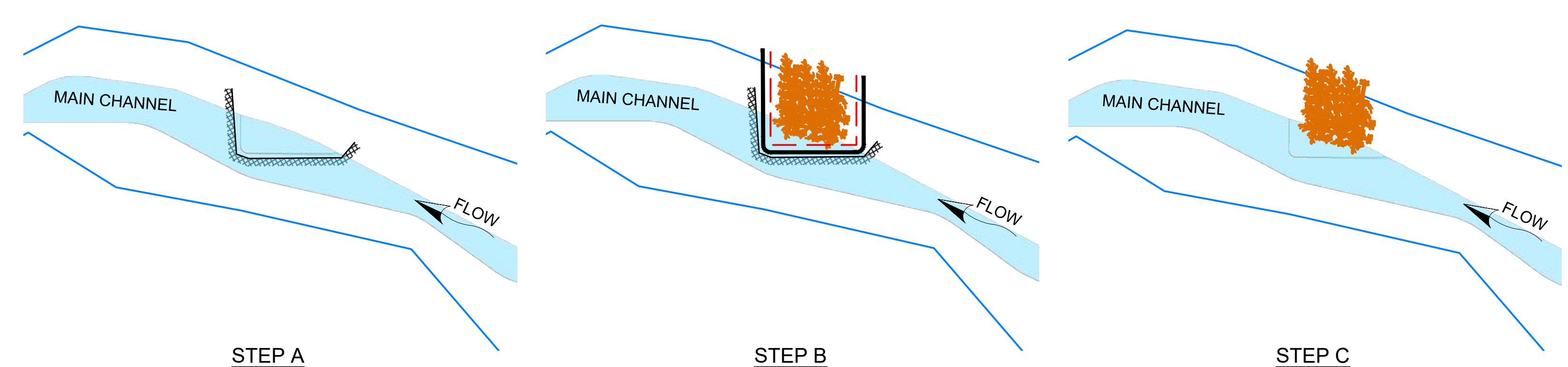
B) DEWATERING AND INSTALLATION: INSTALL COFFERDAM AND DEWATER ISOLATED WORK AREA. ALL ISOLATION WORK AND DEWATERING ACTIVITIES SHALL BE IN ACCORDANCE WITH HIP III GUIDELINES. EXCAVATE AND INSTALL LARGE WOODY DEBRIS (LWD) STRUCTURES AS SHOWN ON THE THE CONSTRUCTION PLAN SHEETS AND IN ACCORDANCE WITH PROJECT SPECIFICATIONS.

C) REWATERING: WHEN NECESSARY PERFORM STAGED REWATERING PROCESS WITH THE RECENTLY INSTALLED STRUCTURE. PREWASH CHANNEL AND DETAIN AND RELEASE TURBID WATER TO THE FLOODPLAIN RATHER THAN FISH BEARING WATER IN ACCORDANCE WITH STAGED REWATERING PLAN. PERFORM TURBIDITY MONITORING PROTOCOL.

D) SITE RESTORATION: STREAMBANKS AND DISTURB AREA SHALL BE RESTORED AS NECESSARY USING ONSITE NATIVE MATERIAL AND ALL PROJECT WASTE MATERIAL REMOVED. ALL REWATERING ACTIVITIES, CONSTRUCTION, AND POST-CONSTRUCTION CONSERVATION MEASURES SHALL BE IN ACCORDANCE WITH THE PROJECT PLANS AND SPECIFICATIONS.

<u>GENERAL FISH SALVAGE NOTES:</u>

1. PROPOSED PROJECT DESIGN, CONSTRUCTION ACTIVITIES, AND MATERIALS SUBJECT TO APPROVAL BY OWNER.
2. CONTRACTOR TO PROVIDE EROSION AND SEDIMENT CONTROL PLAN PER PROJECT PLAN AND SPECIFICATIONS.
3. CONTRACTOR TO PROVIDE DEWATERING PLAN PER PROJECT PLANS AND SPECIFICATIONS.
4. THE CONTRACTOR SHALL CONSTRUCT THE RESTORATION DESIGN ELEMENTS IN ACCORDANCE WITH THE PLANS STAMPED "ISSUED FOR CONSTRUCTION" AS PROVIDED TO THE CONTRACTOR BY THE OWNER PRIOR TO CONSTRUCTION.
5. ALL WORK WITHIN THE ACTIVE CHANNEL SHALL OCCUR WITHIN THE ALLOWABLE FISH WINDOW (TBD). ALL CONSTRUCTION ACTIVITIES SHALL MINIMIZE DISTURBANCE TO AND MAXIMIZE RE-USE OF EXISTING RIPARIAN VEGETATION.
6. ALL TEMPORARY ACCESS ROUTES SHALL BE LAID OUT TO MINIMIZE DISTURBANCE TO EXISTING VEGETATION AND FINAL LOCATION WILL BE VERIFIED BY OWNER.
7. ALL EROSION CONTROL MEASURES ARE TO INDICATE WHAT IS EXPECTED IN SIMILAR GEOMORPHIC CONDITIONS. CHANNEL CONDITIONS MAY DIFFER DURING CONSTRUCTION AND FIELD ADJUSTMENT SHALL BE COORDINATED WITH PROJECT OWNER.
8. OWNER SHALL BE RESPONSIBLE FOR FISH SALVAGE EFFORTS.
9. CONSTRUCTION WORK IN THE IMMEDIATE VICINITY OF FISH SALVAGE EFFORTS SHALL BE DELAYED (TYPICALLY 2 TO 24 HOURS) DURING SALVAGE. DELAYS MAY BE LONGER IN SOME CASES.



LWD INSTALLATION WITH LOCAL ISOLATION (TYP.)

(NOT TO SCALE)

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Yakama Nation Fisheries

NOT FOR CONSTRUCTION

REV.	DATE	REVISION DESCRIPTION	DRW	ENG	CHK	APP
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YAKAMA NATION FISHERIES
TWISP TO CARLTON REACH
ALDER CREEK FLOODPLAIN PROJECT
PERMIT LEVEL DESIGN

DEWATERING AND REWATERING DETAILS

DWG. NO.: C-302

CREATED: 12/11/2018

Z:\PROJECTS\194-6189 YNF_TWISP TO CARLTON\ALDER CREEK REACH\2 PERMIT DESIGN\SHEET FILES\ALDER CREEK FLOODPLAIN\07_DEWATER AND REWATERING.DWG
PLOT DETAILS: BAILEY, CHAD April 24, 2019 11:43 AM

SPECIAL PROVISIONS

INTRODUCTION

THE WASHINGTON STATE DEPARTMENT OF TRANSPORTATION'S STANDARD SPECIFICATIONS FOR ROAD, BRIDGE AND MUNICIPAL CONSTRUCTION 2018 (WSDOT STANDARD SPECIFICATIONS) SHALL APPLY UNLESS OTHERWISE NOTED IN THE FOLLOWING SPECIAL PROVISIONS. THE "CONTRACTING AGENCY" OR "OWNER" SHALL REFER TO THE CONFEDERATED TRIBES AND BANDS OF THE YAKAMA NATION. ADDITIONAL SPECIFICATIONS IN THE FOLLOWING CONTRACT SECTIONS ARE INCLUDED FOR ITEMS NOT COVERED BY THE WASHINGTON STATE DEPARTMENT OF TRANSPORTATION (WSDOT) STANDARD SPECIFICATIONS.

DIVISION 1 - GENERAL REQUIREMENTS

SECTIONS 1-02, 1-03, AND 1-08 (EXCEPT 1-08.6, 1-08.7, 1-08.8) OF THE STANDARD SPECIFICATIONS DO NOT APPLY.

ITEM 001 - MOBILIZATION

THIS ITEM SHALL CONSIST OF PREPARATION WORK AND OPERATIONS PERFORMED BY THE CONTRACTOR IN ACCORDANCE WITH THE PROVISIONS OF SECTION 1-09.7 OF THE WSDOT STANDARD SPECIFICATIONS (STANDARD SPECIFICATIONS).

TEMPORARY SITE ACCESS SHALL BE ALONG ALIGNMENTS SHOWN IN THE PLANS. MINOR DEVIATIONS TO THE ALIGNMENTS MAY OCCUR AS DIRECTED BY THE OWNER TO PRESERVE SENSITIVE AREAS OR TREES, OR TO AVOID DAMAGE TO FENCE POSTS OR OTHER FEATURES IDENTIFIED IN THE FIELD. AT NO TIME DURING MOBILIZATION OR CONSTRUCTION IS CONTRACTOR ALLOWED TO DAMAGE LIVE TREES OR VEGETATION, UNLESS OTHERWISE DIRECTED BY THE OWNER. DEVIATIONS FROM THE ALIGNMENTS SHOWN IN THE PLANS SHALL BE APPROVED BY OWNER PRIOR TO USE. IF FENCE IS REMOVED TO FACILITATE ACCESS OR CONSTRUCTION, THE CONTRACTOR SHALL REPLACE OR REPAIR FENCE AT NO ADDITIONAL COST TO THE OWNER. SITE ACCESS ROUTES AND STAGING AREAS SHALL BE MAINTAINED AND RESTORED TO ORIGINAL OR BETTER CONDITION. IF TEMPORARY TRAFFIC CONTROL REQUIREMENTS SHALL INCLUDE CONSTRUCTION SIGNAGE AT THE ENTRANCE OF THE PROJECT SITE OR ANY OTHER TRAFFIC CONTROL MEASURE REQUIRED BY STATE OR LOCAL REGULATIONS, THIS WILL BE INCIDENTAL TO MOBILIZATION COST.

<u>MEASUREMENT</u>
"MOBILIZATION" WILL BE MEASURED BY LUMP SUM.

<u>PAYMENT</u>
PAYMENT FOR MOBILIZATION SHALL BE BY THE LUMP SUM CONTRACT PRICE FOR, 'MOBILIZATION', PARTIAL PAYMENTS WILL BE MADE AS IN ACCORDANCE WITH SECTION 1-09.9 OF THE STANDARD SPECIFICATIONS. PAYMENT SHALL BE CONSIDERED FULL COMPENSATION FOR ALL EQUIPMENT, LABOR, TOOLS, MATERIALS, AND INCIDENTALS NECESSARY TO COMPLETE THIS WORK AS SPECIFIED.

ITEM 002 - CLEARING AND GRUBBING

THIS ITEM CONSISTS OF CLEARING AND GRUBBING FOR CONSTRUCTION AS SHOWN ON THE PLANS INCLUDING THOSE AREAS REQUIRED FOR TEMPORARY ACCESS ROUTES AND IN ACCORDANCE WITH SECTION 2-01 OF THE STANDARD SPECIFICATIONS, AND AS AMENDED BY THESE SPECIAL PROVISIONS.

1. AREAS FOR CLEARING AND GRUBBING ARE SHOWN IN THE PLANS. ADJUSTMENTS TO ALIGNMENTS AND EXTENTS MAY BE ADJUSTED BY THE OWNER TO REDUCE DAMAGE TO THE ENVIRONMENT. THE FINAL AREAS WILL BE FLAGGED IN THE FIELD BY THE OWNER PRIOR TO CLEARING AND GRUBBING WORK. CLEARING AND GRUBBING SHALL NOT OCCUR OUTSIDE OF THE DESIGNATED LIMITS.

2. ALL SHRUBS REMOVED DURING CLEARING AND GRUBBING SHALL BE LEFT ONSITE, PLACED OUTSIDE OF LIMITS OF DISTURBANCE TO BE USED AS SLASH DURING INSTALLATION OF LOGS. EXCESS SLASH, INCLUDING SLASH THAT MAY HAVE BEEN IMPORTED BY OWNER, AND EXCESS LOGS SHALL BE HAULED OFFSITE TO LOG YARD IN TWISP AT THE CONTRACTORS EXPENSE.

3. VEGETATION PROTECTION AND RESTORATION PER SECTION 1-07.16(2) SHALL BE INCIDENTAL TO CLEARING AND GRUBBING.

<u>MEASUREMENT</u>
"CLEARING AND GRUBBING" WILL BE MEASURED BY LUMP SUM.

<u>PAYMENT</u>
PAYMENT WILL BE MADE IN ACCORDANCE WITH SECTION 1-09.9 FOR THE FOLLOWING BID ITEMS: "CLEARING AND GRUBBING" PER LUMP SUM.

ITEM 003 - SPCC AND TESC PLANS AND IMPLEMENTATION

THIS WORK SHALL PROVIDE FOR THE PREPARATION AND IMPLEMENTATION OF A SPILL PREVENTION CONTROL AND COUNTERMEASURES (SPCC) PLAN IN ACCORDANCE WITH SECTION 1-07.15 OF THE STANDARD SPECIFICATIONS AND PREPARATION, IMPLEMENTATION, AND REMOVAL OF A TEMPORARY EROSION SEDIMENT CONTROL (TESC) PLAN IN ACCORDANCE WITH SECTION 8-01 OF THE STANDARD SPECIFICATIONS, AND AS AMENDED BY THESE SPECIAL PROVISIONS.

1. THE CONTRACTOR SHALL SUBMIT A SPCC AND TESC PLAN FOR THE PROJECT TO THE OWNER FOR APPROVAL. THE TESC MUST SATISFY THE REQUIREMENTS OF THE WASHINGTON DEPARTMENT OF ECOLOGY NPDES STORMWATER GENERAL PERMIT FOR CONSTRUCTION ACTIVITY AND ALL OTHER APPLICABLE PERMITS. THE TESC INCLUDED IN THE DRAWINGS AND DESCRIBED HEREIN IS INTENDED TO PROVIDE A BASELINE FOR SEDIMENT AND EROSION CONTROL AND DOES NOT ENSURE THAT THE STANDARDS ESTABLISHED BY ANY APPLICABLE PERMITS WILL BE MET. THE CONTRACTOR MAY USE THESE MEASURES OR ALTERNATIVE MEASURES OF THEIR OWN DESIGN, BUT ANY ALTERNATIVE MUST BE APPROVED BY THE OWNER. TO ENSURE SATISFACTORY PERFORMANCE AND THAT THE EROSION CONTROL REQUIREMENTS OF ALL APPLICABLE PERMITS ARE MET. THE CONTRACTOR SHALL BE NAMED AS THE PERMIT HOLDER. THE CONTRACTOR SHALL BE RESPONSIBLE FOR IMPLEMENTING, INSPECTING AND FILING REPORTS, MAINTAINING, REPLACING, AND REMOVING TESC AND SPCC MEASURES. THE PLAN SHALL INCLUDE THE NAME, ADDRESS AND 24-HOUR CONTACT NUMBER FOR THE PERSON RESPONSIBLE FOR EROSION PREVENTION AND SEDIMENT CONTROL MEASURES.

ITEM 004 - COFFERDAMS

THIS ITEM SHALL CONSIST OF PROVIDING AND INSTALLING, MAINTAINING, AND REMOVING MEASURES TO BYPASS THE SURFACE WATERS OF THE METHOW RIVER AROUND IN-CHANNEL WORK AREAS, AND TO PREVENT TURBIDITY FROM ENTERING THE RIVER. WORK PERFORMED BY THE CONTRACTOR SHALL BE IN ACCORDANCE WITH THE PROVISIONS OF SECTION 2-09.3(3)D OF THE STANDARD SPECIFICATIONS.

COFFERDAMS SHOWN ON THE PLANS IS ONE ACCEPTABLE METHOD. THE CONTRACTOR MAY USE THIS METHOD OR PROPOSE A DIFFERENT METHOD THAT PROVIDES EQUAL OR BETTER ISOLATION OF THE WORK AREA FROM THE METHOW RIVER FLOW. IF A DIFFERENT METHOD IS PROPOSED, THE CONTRACTOR SHALL SUBMIT DRAWINGS DETAILING THE PROPOSED METHOD(S) FOR PROVIDING TEMPORARY ISOLATION OF SURFACE WATER DURING CONSTRUCTION ACTIVITIES. REVIEW AND APPROVAL OF THE COFFERDAM METHOD SHALL NOT RELIEVE THE CONTRACTOR FROM FULL RESPONSIBILITY FOR THE ADEQUACY OF COFFERDAM WORK IF THE PROPOSED METHOD IS NOT SUCCESSFUL AT SUFFICIENTLY ISOLATING THE WORK AREA FROM THE FLOW. COFFERDAMS SHALL BE SUITABLY OFFSET FROM THE WORK AREA SO AS TO NOT INTERFERE WITH LOG PLACEMENT OR LIMIT POOL EXCAVATION.

COFFERDAM WORK INCLUDES COORDINATING WITH THE OWNER FOR FISH SALVAGE ACTIVITIES.

<u>MATERIALS</u>
THE CONTRACTOR SHALL PROVIDE ALL REQUIRED MATERIALS FOR THE PROJECT, SUCH AS BLOCK NETS, SILT FENCING, FLOATING BOOMS, BULK BAGS, AND//OR OTHER SUITABLE MEANS. IF A BULK BAG COFFERDAM IS THE CHOSEN METHOD TO BE USED, SEE PLAN DETAILS FOR TEMPORARY COFFERDAM. BULK BAG SHALL BE FILLED WITH WASHED PEA GRAVEL OR STREAM GRAVEL.

<u>CONSTRUCTION REQUIREMENTS</u>
CONTRACTOR SHALL CONSTRUCT AND MAINTAIN COFFERDAMS AS NECESSARY AND AS SHOWN ON THE DRAWINGS TO DIVERT AND DE-WATER FISH ISOLATION AREAS FOR ALL WORK ACTIVITIES WITHIN THE WETTED CHANNEL. WATER REMOVED FROM WITHIN THE ISOLATED WORK AREA SHALL BE ROUTED TO AN AREA APPROVED BY THE OWNER'S REPRESENTATIVE TO ALLOW REMOVAL OF FINE SEDIMENT AND OTHER CONTAMINANTS. THE EXISTING FLOW DOWNSTREAM FROM THE PROJECT AREA SHALL BE MAINTAINED THROUGHOUT CONSTRUCTION. THE DIVERSION AND DEWATERING SHALL REMAIN IN PLACE UNTIL IN-STREAM RESTORATION WORK IS COMPLETE AND OWNER'S REPRESENTATIVE OR ENGINEER APPROVES REMOVAL OF THE COFFERDAM SYSTEM.

THE CONTRACTOR SHALL PROVIDED MINIMUM 2 DAYS ADVANCE NOTICE TO THE OWNER BEFORE EACH COFFERDAM INSTALLATION. THE CONTRACTOR SHALL UNDERSTAND THAT COFFERDAM INSTALLATION REQUIRES COORDINATION WITH THE OWNER AND ONLY AFTER THE OWNER HAS COMPLETED FISH RESCUE CAN THE COFFERDAMS BE COMPLETED.

<u>MEASUREMENT</u>
MEASUREMENT WILL BE BASED ON THE ITEM FROM THE BID LIST INSTALLED AND THE WORK FOR THAT PORTION COMPLETED. "COFFERDAMS" WILL BE MEASURED BY LINEAR FEET OF COFFERDAM INSTALLED.

<u>PAYMENT</u>
PAYMENT WILL BE MADE IN ACCORDANCE WITH SECTION 1-09.9 FOR THE FOLLOWING BID ITEMS; "COFFERDAMS" PER LINEAR FOOT.

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Yakama Nation Fisheries

NOT FOR CONSTRUCTION

PLOTTED AS ANSI B (11" X 17"), PLAN SHEET FULL SIZE ANSI D (22" X 34")

REV.	DATE	REVISION DESCRIPTION	DRW	ENG	CHK	APP
D	4/26/19	PERMIT LEVEL DESIGN	CEB	CEB	CM	JT
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YAKAMA NATION FISHERIES
TWISP TO CARLTON REACH
ALDER CREEK FLOODPLAIN PROJECT
PERMIT LEVEL DESIGN

SPECIAL PROVISIONS

DWG. NO.: C-401

CREATED: 12/11/2018

SPECIAL PROVISIONS

ITEM 005 - WATER MANAGEMENT/PUMPING

THIS ITEM SHALL CONSIST OF PREPARATION WORK AND OPERATIONS PERFORMED BY THE CONTRACTOR IN ACCORDANCE WITH THE PROVISIONS OF SECTION 8-01.3(1)C OF THE STANDARD SPECIFICATIONS.

WORK IN THIS SECTION CONSISTS OF THE INSTALLATION AND REMOVAL OF A WATER MANAGEMENT SYSTEM TO DEWATER AND CONTROL TURBIDITY WITHIN CONSTRUCTION AREAS ISOLATED FROM THE METHOW RIVER BY COFFERDAMS FOR THE CONSTRUCTION OF IN-CHANNEL LOG JAMS AND LWD STRUCTURES.

MATERIALS

IF ANY BYPASS PUMPING IS APPROVED BY ENGINEER OR OWNER'S REPRESENTATIVE, THE CONTRACTOR SHALL ALSO PROVIDE PUMPS WITH ADEQUATE PUMP CAPACITY, HOSES, AND PERSONNEL AS BACKUP TO THE TEMPORARY STREAM FLOW BYPASS SYSTEM IN THE EVENT THE SYSTEM BECOMES NON-OPERATIONAL, AS MAY BE REQUIRED DURING CONSTRUCTION WHEN FLOW RATES IN THE EXISTING CHANNEL EXCEED THE DESIGN CAPACITY OF THE GRAVITY BYPASS, OR TO MAINTAIN A DRY WORK AREA WHEN INSTALLING LOG JAMS AND LWD STRUCTURES. PUMPS AND HOSES MAY ALSO BE USED TO PUMP SEEPAGE FLOW THROUGH THE COFFERDAM INTO THE BYPASS PIPELINE TO KEEP WATER OUT OF THE WORK AREA. TURBID WATER SHALL BE DISCHARGED TO AN APPROVED AREA WITH SUFFICIENT CAPACITY TO ALLOW FOR SLOW INFILTRATION AND REMAIN DISCONNECTED FROM ACTIVE FLOW CHANNEL. THE CONTRACTOR SHALL MONITOR PUMPING OPERATION AT ALL TIMES.

ANY PUMPING OPERATION SHALL USE A FISH SCREEN THAT IS IN ACCORDANCE WITH THE NATIONAL MARINE FISHERIES SERVICE STANDARDS. PUMP INTAKE SCREENS SHALL BE SIZED TO PREVENT FISH FROM BEING ENTRAINED INTO THE PUMP INTAKE OR FROM BEING IMPINGED ON THE INTAKE SCREEN. THE SCREEN FACE SHOULD BE ORIENTED PARALLEL TO FLOW FOR BEST SCREENING PERFORMANCE. THE SCREEN SHALL BE DESIGNED AND USED SUCH THAT IT CAN BE SUBMERGED WITH AT LEAST ONE-SCREEN-HEIGHT-CLEARANCE ABOVE AND BELOW THE SCREEN.

CONSTRUCTION REQUIREMENTS

THE CONTRACTOR SHALL PROVIDE AND OPERATE TRASH PUMPS THAT ARE APPROPRIATELY SIZED TO LOWER THE WATER SURFACE WITHIN THE ISOLATED AREA AND DISCHARGE TO AN INFILTRATION AREA. DURING SIDE CHANNEL CONSTRUCTION, CONSTRUCTION WATER SHALL BE PUMPED AWAY FROM WORK AREAS AND INFILTRATED INTO THE GROUND WITHOUT ENTERING THE WATERWAY OR WETLAND AREAS.

IF INFILTRATION BECOMES INEFFECTIVE TO CONTROL TURBIDITY, ADDITIONAL AND/OR ALTERNATIVE METHODS, SUCH AS PUMPING INTO STILLING BASINS OR FILTRATION GEOTEXTILE FABRIC SHALL BE REQUIRED AT THE CONTRACTOR'S EXPENSE.

MEASUREMENT

MEASUREMENT SHALL BE BASED ON THE ITEM FROM THE BID LIST INSTALLED AND THE WORK FOR THAT PORTION COMPLETED.

"WATER MANAGEMENT/PUMPING" WILL BE MEASURED BY LUMP SUM.

PAYMENT

PAYMENT FOR "WATER MANAGEMENT/PUMPING" SHALL BE BY THE LUMP SUM CONTRACT PRICE FOR AS IN ACCORDANCE WITH SECTION 1-09.9 OF THE STANDARD SPECIFICATIONS. PAYMENT SHALL BE CONSIDERED FULL COMPENSATION FOR ALL EQUIPMENT, LABOR, TOOLS, MATERIALS, AND INCIDENTALS NECESSARY TO COMPLETE THIS WORK AS SPECIFIED. IF ADDITIONAL ENVIRONMENTAL PROTECTION MEASURES ARE REQUIRED TO CONTROL TURBIDITY, THEY SHALL BE CONSIDERED INCIDENTAL TO PUMPING AND NOT ADDITIONAL COMPENSATION WILL BE MADE.

DIVISION 2 - EARTHWORK

ITEM 006: SIDE CHANNEL

THIS ITEM CONSISTS OF EXCAVATING, LOADING, HAULING, PLACING, AND EMBANKMENT COMPACTING FOR THE PROPOSED SIDE CHANNEL, OR OTHERWISE DISPOSING OF THE MATERIAL IN ACCORDANCE WITH SECTION 2-03 OF THE STANDARD SPECIFICATIONS, AND AS AMENDED BY THESE SPECIAL PROVISIONS.

1. PORTIONS OF THE WORK WILL INCLUDE EXCAVATION BELOW GRADE. THE CONTRACTOR SHALL BE ADVISED THAT GROUNDWATER WILL BE ENCOUNTERED THROUGHOUT EXCAVATION AREAS.
2. THESE ITEMS INCLUDE HAULING OF EXCAVATED MATERIAL TO LWD STRUCTURES . THE CONTRACT PRICE SHALL INCLUDE "HAUL".
3. THIS ITEM INCLUDES GRADING TO SHAPE THE SIDE CHANNEL, INCLUDING CREATING POOLS WITHIN THE CHANNELS AS SHOWN IN THE DRAWINGS. POOLS SHALL BE OVEREXCAVATED TO PROVIDE ROOM TO INSTALL LOGS AS SHOWN IN THE DRAWINGS.
4. NO WORK SHALL OCCUR OUTSIDE OF THE LIMITS OF DISTURBANCE SHOWN IN THE DRAWINGS UNLESS AUTHORIZED BY THE OWNER.

MATERIALS

THE CONTRACTOR SHALL PROVIDE ALL REQUIRED MATERIALS FOR THE PROJECT, SUCH AS RIFFLE BOULDERS AND SIDE CHANNEL COBBLE IF NECESSARY. THE EXCAVATED SIDE CHANNEL BED MATERIAL SHALL CONSIST OF NATIVE ALLUVIUM SIMILAR TO THE METHOW RIVER. IF FINER MATERIAL IS ENCOUNTERED AND NOT SUITABLE FOR THE CHANNEL BED MATERIAL CONTRACTOR SHALL FURNISH STREAMBED COBBLES MATCHING 8" COBBLE GRADATION SHOWN IN SECTION 9-03.11(2) OF THE STANDARD SPECIFICATIONS.

CONSTRUCTION REQUIREMENTS

1. PLACE STREAMBED COBBLES IN ONE OR MORE LAYERS WITH A LAYER DEPTH LESS THAN 1½ TIMES THE MAXIMUM DIMENSION OF THE STREAMBED COBBLE, BUT NO GREATER THAN 1 FOOT. PLACEMENT SHALL BE BY METHODS THAT DO NOT CAUSE SEGREGATION OR DAMAGE TO THE PREPARED SURFACE. PLACE OR REARRANGE INDIVIDUAL COBBLES TO OBTAIN A UNIFORMLY DENSE, COMPACT, LOW PERMEABILITY MASS. FILL VOIDS BY MACHINE OR HAND TAMPING BEFORE PLACING THE NEXT LIFT. COMPACT BED MATERIALS BY MECHANICAL MEANS SUCH AS PLATE COMPACTORS, LOADERS, ETC.
2. FILL ALL VOIDS LEFT DURING PLACEMENT OF STREAMBED COBBLES AS SHOWN ON THE DRAWINGS. USE WATER PRESSURE, METAL TAMPING RODS, AND SIMILAR HAND-OPERATED EQUIPMENT TO FORCE MATERIAL INTO ALL SURFACES AND SUBSURFACE VOIDS BETWEEN THE STRUCTURE AND ROCKS, AND BETWEEN INDIVIDUAL ROCKS.
3. ONCE ALL THE STREAMBED COBBLE MATERIALS HAVE BEEN PLACED AND BEFORE THE STREAM BED IS OPEN TO STREAM FLOWS, THE CONTRACTOR SHALL WASH IN FINES FROM SELECTED ON SITE MATERIALS APPROVED BY THE OWNER'S REPRESENTATIVE TO SEAL THE GRAVELS TO KEEP THE INTRODUCED WATER ON THE SURFACE AND AVOID HAVING THE CREEK GO UNDERGROUND THROUGH THE NEW STREAM BED. FINES SHALL BE WASHED IN UNTIL PONDING OCCURS ON THE SURFACE OF EACH LIFT PRIOR TO PLACING NEXT LIFT.
4. WATER THAT FLOWS OFF THE STREAM BED DURING THE WASH-IN PROCESS SHALL BE PROPERLY DISPOSED OF IN ACCORDANCE WITH THE APPROVED TEMPORARY EROSION AND SEDIMENT CONTROL PLAN.
5. ONCE FINES HAVE BEEN WASHED IN, THE SURFACE SHALL BE FLUSHED SO FLOWS COMING OFF THE NEW STREAM BED DO NOT INCREASE THE TURBIDITY OVER EXISTING LEVELS IN THE UPSTREAM CREEK, AS APPROVED BY THE OWNER'S REPRESENTATIVE.

MEASUREMENT

"SIDE CHANNEL" WILL BE MEASURED BY LUMP SUM. MEASUREMENT SHALL BE BASED ON THE ITEM FROM THE BID LIST INSTALLED AND THE WORK FOR THAT PORTION COMPLETED. NO ADDITIONAL COMPENSATION WILL BE MADE FOR EXCAVATED MATERIAL THAT IS STOCKPILED, RE-EXCAVATED, AND MOVED AGAIN.

PAYMENT

PAYMENT FOR "SIDE CHANNEL" SHALL BE BY THE LUMP SUM CONTRACT PRICE FOR AS IN ACCORDANCE WITH SECTION 1-09.9 OF THE STANDARD SPECIFICATIONS. PAYMENT SHALL BE CONSIDERED FULL COMPENSATION FOR ALL EQUIPMENT, LABOR, TOOLS, MATERIALS, AND INCIDENTALS NECESSARY TO COMPLETE THIS WORK AS SPECIFIED.

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YAKAMA NATION FISHERIES
TWISP TO CARLTON REACH
ALDER CREEK FLOODPLAIN PROJECT
PERMIT LEVEL DESIGN

SPECIAL PROVISIONS

DWG. NO.: C-402

CREATED: 12/11/2018

SHEET: 16 OF 17

SPECIAL PROVISIONS

ITEM 007 - 009: LOG JAM STRUCTURE, 2-LOG CROSS STRUCTURE, BANK HABITAT STRUCTURE

WORK UNDER THIS SECTION CONSISTS OF THE LOG JAM STRUCTURE, 2- LOG CROSS STRUCTURES, AND BANK HABITAT STRUCTURES INCLUDED IN THE RESTORATION OF THE METHOW RIVER AND FLOODPLAIN. ALL LOG STRUCTURE ITEMS INCLUDES ALL REFERENCES TO INSTALLING LOGS, LOGS WITH ROOTWADS, AND SLASH AS SHOWN IN THE DRAWINGS AND THESE SPECIAL PROVISIONS. THESE ITEMS INCLUDE MOVEMENT FROM STOCKPILES TO INSTALLATION LOCATIONS, EXCAVATION AND BACKFILL TO PARTIALLY BURY LOG STRUCTURES, AND INSTALLING SLASH TO SEAL EACH STRUCTURE OR AS DIRECTED BY THE OWNER.

MATERIALS

1. ALL LOGS WILL BE FURNISHED BY THE OWNER. CONTRACTOR WILL BE RESPONSIBLE FOR MOVING LOGS TO INSTALLATION SITES. SOME ONSITE SALVAGED TREES MAY ALSO BE USED, AS PER OWNERS REQUEST.
2. LARGE WOOD MATERIAL LOGS SHALL CONSIST OF EITHER A STRAIGHT TIMBER BOLE OR A STRAIGHT TIMBER BOLE WITH ROOTWAD ATTACHED, AS SHOWN ON THE DRAWINGS. NOMINAL ROOTWAD DIAMETER SHALL BE A MINIMUM OF TWO TIMES THE TIMBER BOLE DIAMETER AND A MAXIMUM OF FOUR TIMES THE TIMBER BOLE DIAMETER. LARGE WOOD MATERIAL LOGS SHALL BE TO THE DIMENSIONS AS SPECIFIED IN THE DRAWINGS.
3. VERTICAL PILINGS SHALL CONSIST OF A STRAIGHT TIMBER BOLE AND SHALL BE TO THE DIMENSIONS AS SPECIFIED IN THE DRAWINGS.
4. SLASH INCLUDES SHRUBS AND SMALL TREES REMOVED WITHIN THE CLEARING LIMITS, OR PROVIDED BY THE OWNER AT STOCKPILES NEAR THE INSTALLATION SITES.

CONSTRUCTION REQUIREMENTS

1. IN-STREAM WOOD STRUCTURES INCLUDE LOG JAM STRUCTURE, 2-LOG CROSS STRUCTURES, AND BANK HABITAT STRUCTURES.
2. THE OVERALL PLAN FORM OF ALL WOOD GROUP STRUCTURES WILL BE CONSTRUCTED AS SHOWN ON THE DRAWINGS OR AS DIRECTED IN THE FIELD BY OWNER'S REPRESENTATIVE OR ENGINEER.
3. REFER TO DRAWINGS FOR SEQUENCE AND SPECIFIED DIMENSIONS OF LOGS, LOGS WITH ROOTWADS, AND VERTICAL PILINGS TO BE INSTALLED FOR EACH STRUCTURE.
4. ORIENTATION AND PLACEMENT OF THE LOGS WILL BE ADJUSTED DEPENDING ON THE TYPE OF STRUCTURE BEING INSTALLED.
5. EXCAVATED MATERIAL FROM THE SIDE CHANNEL AND DURING TRENCH INSTALLATION WILL BE BACKFILLED AND COMPACTED AROUND THE STRUCTURES AS SOIL BALLAST. COMPACTION WILL BE COMPLETED USING THE EXCAVATOR BUCKET. FINISH GRADE WILL BE BLENDED INTO THE SURROUNDING BANK OR FLOODPLAIN.
6. THE LOG JAM STRUCTURE INCLUDES BUMPER LOGS FOR RECREATIONAL BOATER SAFETY AND SHALL BE HELD IN PLACE BY GALVANIZED HARDWARE AS SHOWN ON THE DRAWINGS. CONTRACTOR SHALL CONNECT VERTICAL TIMBER PILINGS TO BUMPER LOGS WITH 1-1/4" Ø A36 STEEL THREADED RODS, 3/8" x 4" Ø CIRCULAR WASHERS, AND HEAVY HEX NUTS. CONTRACTOR SHALL INSTALL BOLTED CONNECTIONS IN ACCORDANCE WITH SECTION 6-03.3(33) OF THE STANDARD SPECIFICATIONS.
7. PILES THAT ARE NOT BURIED SHALL HAVE VARYING HEIGHTS ABOVE THE GROUND TO BREAK UP A UNIFORM APPEARANCE. EACH PILE SHALL HAVE A BROKEN TOP (NOT SAWED) UNLESS OTHERWISE DIRECTED BY THE OWNER. THE PREFERRED METHOD SHALL BE TO BREAK OFF THE TOP 4-8 FT PRIOR TO INSTALLATION. PILES MAY BE REQUIRED TO BE INSTALLED AT VARIOUS ANGLES TO PIN DOWN LOGS TO THE FLOODPLAIN SURFACE.
8. BACKFILLING LOG STRUCTURES SHALL BE CONDUCTED SIMULTANEOUSLY WITH INSTALLATION OF LIVE COTTONWOOD TREES ON THE DOWNSTREAM SIDE OF EACH STRUCTURE. ALL MATERIALS AND LABOR TO CONDUCT THE PLANT INSTALLATION WILL BE PROVIDED BY A PLANTING CONTRACTOR UNDER SEPARATE CONTRACT WITH THE OWNER. COORDINATION WILL BE REQUIRED BETWEEN THE CONSTRUCTION CONTRACTOR AND PLANTING CONTRACTOR TO ENSURE TIMING DOES NOT SIGNIFICANTLY INTERRUPT THE FLOW OF WORK. TREES WILL BE PLACED WITH ROOTS IN CONTACT WITH GROUNDWATER WHILE THE STEMS ARE PROTECTED BY PVC TUBES DURING BACKFILLING. THE TREES IN TUBES WILL BE HAND-HELD IN PLACE DURING BACKFILL OPERATIONS.

MEASUREMENT

"LOG JAM STRUCTURE, 2-LOG CROSS STRUCTURE, AND BANK HABITAT STRUCTURE" WILL BE MEASURED BY LUMP SUM PER INDIVIDUAL STRUCTURE. MEASUREMENT SHALL BE BASED ON THE ITEM FROM THE BID LIST INSTALLED AND THE WORK FOR THAT PORTION COMPLETED. NO ADDITIONAL COMPENSATION WILL BE MADE FOR STRUCTURE MATERIAL THAT IS STOCKPILED AND MOVED AGAIN.

PAYMENT

PAYMENT FOR "LOG JAM STRUCTURE, 2-LOG CROSS STRUCTURE, AND BANK HABITAT STRUCTURE" SHALL BE BY THE LUMP SUM CONTRACT PER INDIVIDUAL STRUCTURE PRICE FOR AS IN ACCORDANCE WITH SECTION 1-09.9 OF THE STANDARD SPECIFICATIONS. PAYMENT SHALL BE CONSIDERED FULL COMPENSATION FOR ALL EQUIPMENT, LABOR, TOOLS, MATERIALS, AND INCIDENTALS NECESSARY TO COMPLETE THIS WORK AS SPECIFIED.

ITEM 010: STANDBY TIME

OCCASIONALLY ENVIRONMENTAL FACTORS AND/OR PERMIT REGULATIONS REQUIRE CONSTRUCTION PROJECTS TO TEMPORARILY SHUT DOWN CONSTRUCTION ACTIVITIES TO AVOID ADVERSE IMPACTS TO SENSITIVE RESOURCES. A DECLARATION OF A LEVEL IV INDUSTRIAL FIRE PRECAUTION LEVEL BY FIRE MANAGEMENT AGENCIES IS ONE EXAMPLE OF AN ENVIRONMENTAL FACTOR THAT COULD FORCIBLY INTERRUPT CONSTRUCTION WORK ON SITE FOR A MATTER OF DAYS TO WEEKS. SHOULD REGULATIONS OR RESTRICTIONS BE ENFORCED UPON PROJECT CONSTRUCTION ACTIVITIES RESULTING FROM ENVIRONMENTAL FACTORS BEYOND THE CONTROL OF THE CONTRACTOR OR THE OWNER, THE CONTRACTOR WILL DISCUSS OPTIONS WITH THE OWNER TO DETERMINE THE BEST COURSE OF ACTION FOR MAINTAINING THE PROJECT TIMELINES, PRESERVING THE GOOD FAITH COST ESTIMATES FOR IMPLEMENTING THE PROJECT AS DESIGNED, AND PROTECTING THE CONTRACTOR FROM BEING RESPONSIBLE FOR COST OVERRUNS RELATED TO THE MANDATORY SHUT DOWN.

DISCHARGING STAFF FROM THE PROJECT DURING SHUT DOWN PERIODS IS ONE WAY TO CONTROL PAYROLL COSTS THAT COULD BE INCURRED BY THE CONTRACTOR. HOWEVER, THE OWNER RECOGNIZES THAT LEAVING HEAVY CONSTRUCTION EQUIPMENT AT THE SITE CAN BE A COST BURDEN TO THE CONTRACTOR IF THAT EQUIPMENT COULD BE TEMPORARILY REDEPLOYED AT OTHER UNAFFILIATED PROJECT SITES DURING THE SHUTDOWN PERIOD. FOR THIS REASON, THE OWNER SHALL ALLOW THE CONTRACTOR TO CHARGE PRE-DETERMINED STANDBY RATES BY A UNIT OF TIME FOR PRE-IDENTIFIED PIECES OF HEAVY EQUIPMENT IN ORDER TO PRESERVE THE OPPORTUNITY FOR THE EQUIPMENT TO NOT BE MOBILIZED AWAY FROM THE PROJECT SITE. DETERMINATION OF WHEN STANDBY TIME SHALL BE ASSESSED BY THE CONTRACTOR WILL BE AGREED UPON BY MUTUAL CONSENT BETWEEN THE CONTRACTOR AND THE OWNER IN ADVANCE WHEN SHUT DOWN NOTICES ARE IMMINENT. AS SUCH, IT IS REQUIRED THAT THE CONTRACTOR PROVIDE A SCHEDULE OF RATES FOR STANDBY TIME BY PIECE OF EQUIPMENT SO THAT ALL SUCH COSTS TO THE PROJECT ARE KNOWN IN ADVANCE.

MEASUREMENT

STANDBY TIME WILL BE CALCULATED AT THE DAILY RATE PER PIECE OF EQUIPMENT AS PER THE CONTRACTORS BID PRICE.

PAYMENT

PAYMENT SHALL BE CONSIDERED FULL COMPENSATION FOR ALL EQUIPMENT REMAINING ONSITE DURING THE PERIOD OF WORK STOPPAGE. STANDBY TIME CHARGES WILL ONLY APPLY FOR FULL WORK DAYS WHERE CONSTRUCTION ACTIVITIES ARE NOT POSSIBLE AND WILL NOT BE PRO-RATED BY PARTIAL WORK DAYS OR HOURS ON STANDBY.

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YAKAMA NATION FISHERIES
TWISP TO CARLTON REACH
ALDER CREEK FLOODPLAIN PROJECT
PERMIT LEVEL DESIGN

SPECIAL PROVISIONS

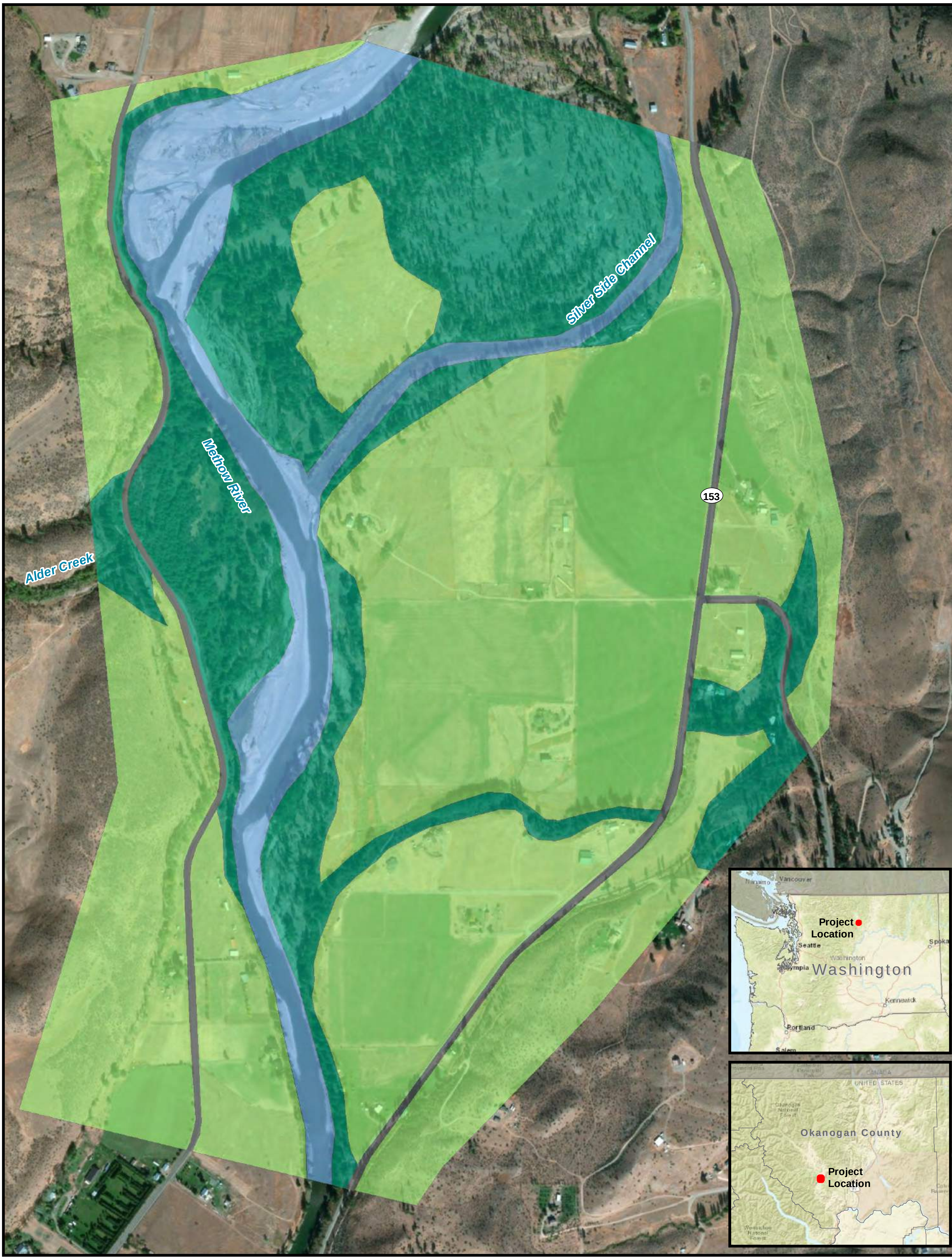
DWG. NO.: C-403

CREATED: 12/11/2018

Z:\PROJECTS\194-6189 YNF_TWISP TO CARLTON\ALDER CREEK REACH\2 PERMIT DESIGN\SHEET FILES\ALDER CREEK FLOODPLAIN\08_SPECIALS.DWG
PLOT DETAILS: BAILEY, CHAD April 24, 2019 11:36 AM ----

APPENDIX B

Hydraulic Modeling Figures



Legend

Land Use

- Agriculture
- Channel
- Forested
- Major Road

Land Use/ Land Cover	Manning's n Value
Agriculture	0.035
Channel	0.032
Forested	0.1
Major Road	0.15

Methow River
Alder Creek Reach
Okanogan County, Washington

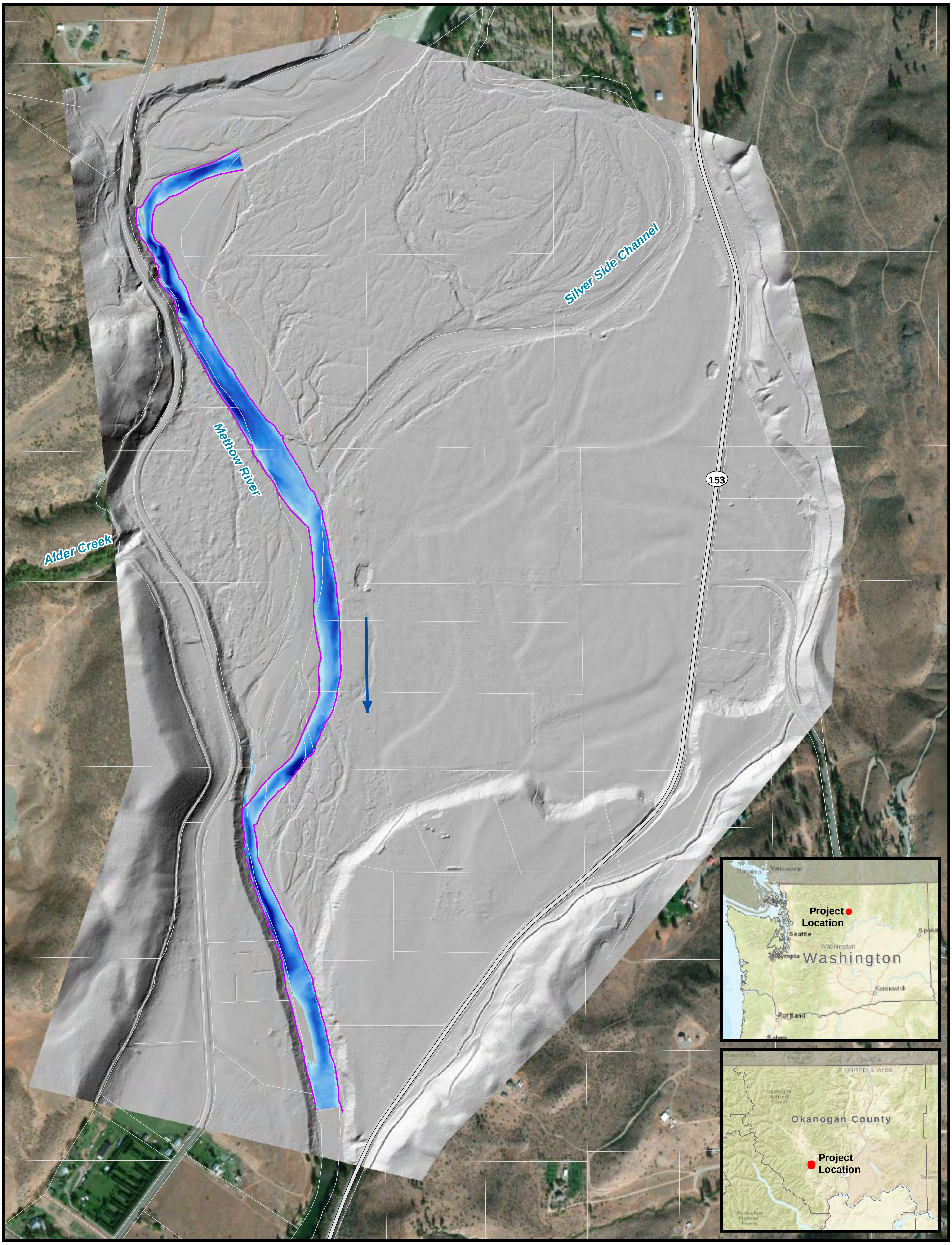
N

0 500 1,000
Feet

Figure 1
Land Use

TETRA TECH

R:\PROJECTS\TWISP_CARLTON_6189\ALDER_CREEK\MAPS\1_AlderCreek_LandUse.mxd



Legend

Flow Direction

Surveyed Edge of Water

Parcel Boundary

Inundation Depth (ft)

High : 5.5

Low : 0

Methow River
Alder Creek Reach
Okanogan County, Washington

N

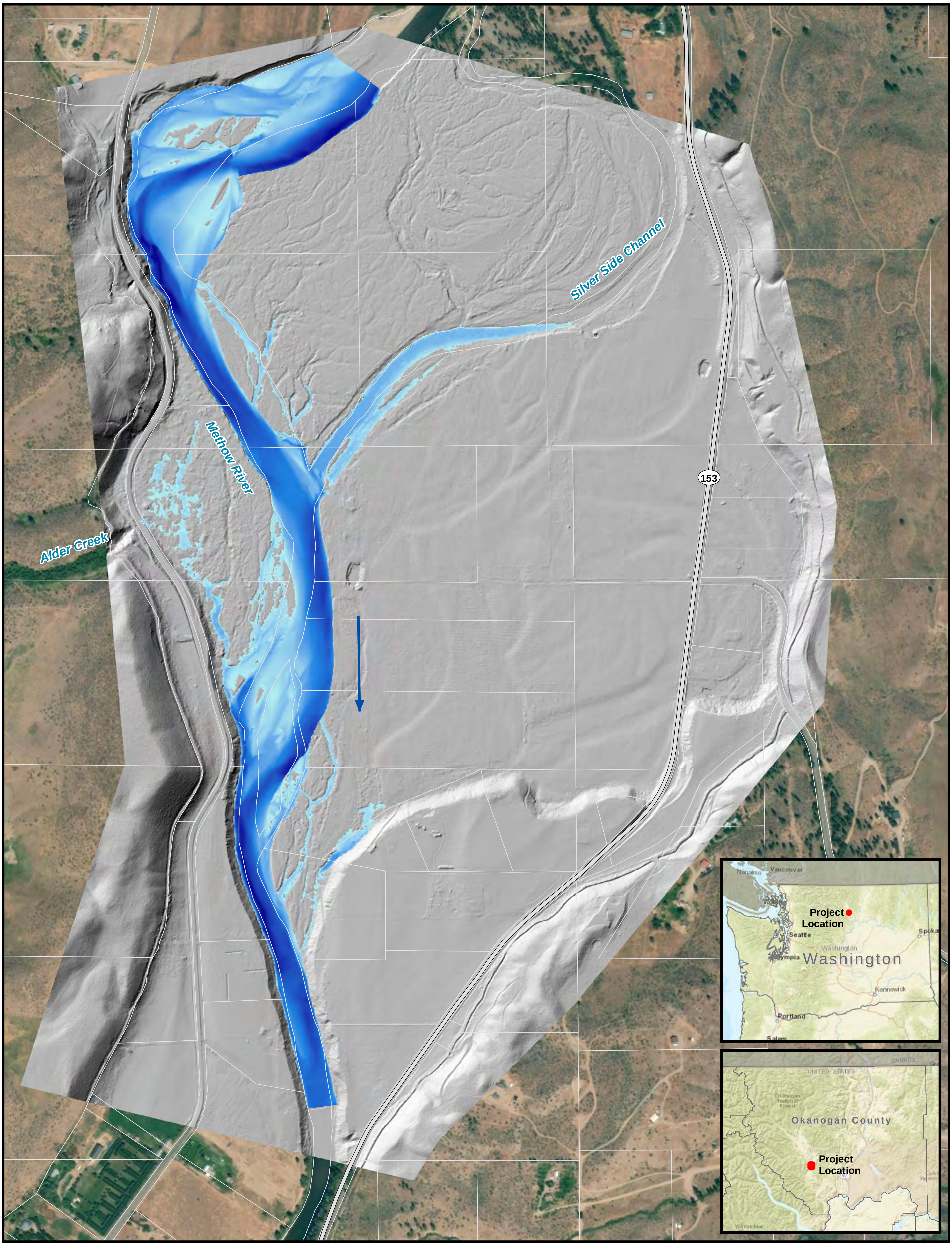
0 1,000 2,000
Feet

Figure 2
Survey Flow
Channel Roughness
Hydraulic Model Calibration

Methow River = 397 cfs

TETRA TECH

R:\PROJECTS\TWISP_CARLTON_6189\ALDER_CREEK\MAPS\2_AlderCreek_SurveyFlow.mxd



Legend

Flow Direction

Parcel Boundary

Inundation Depth (ft)

High : 13.4

Low : 0

Methow River
Alder Creek Reach
Okanogan County, Washington

N

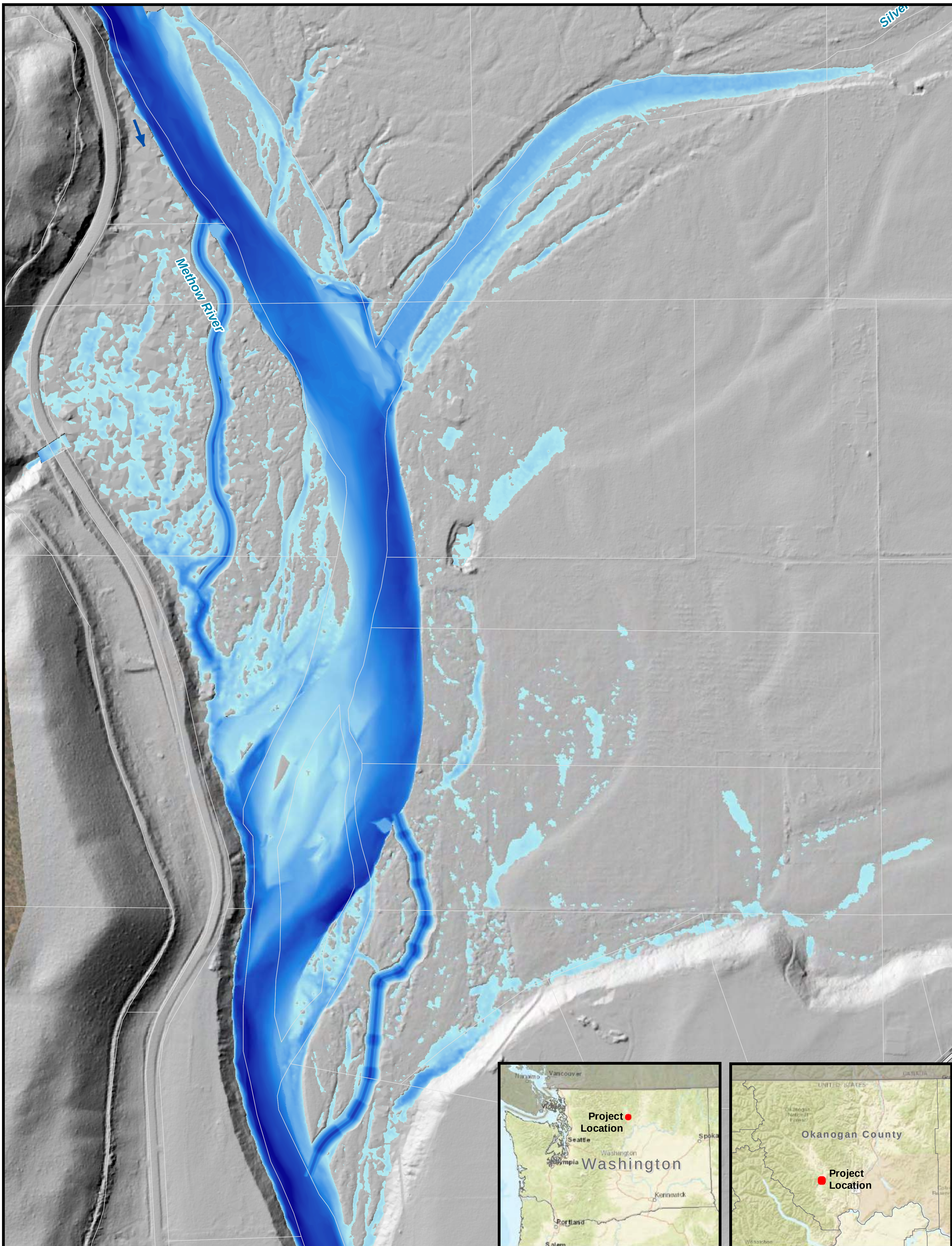
0 1,000 2,000
Feet

Figure 3
2-year Flow
Existing Conditions
Hydraulic Model Inundation

Methow River = 12,276 cfs

TETRA TECH

R:\PROJECTS\TWISP_CARLTON_6189\ALDER_CREEK\MAPS\v10_3\3_AlderCreek_2yr_Inundation.mxd



Legend

Flow Direction

Parcel Boundary

Inundation Depth (ft)

High : 13.6

Low : 0

Methow River
Alder Creek Floodplain Project
Okanogan County, Washington

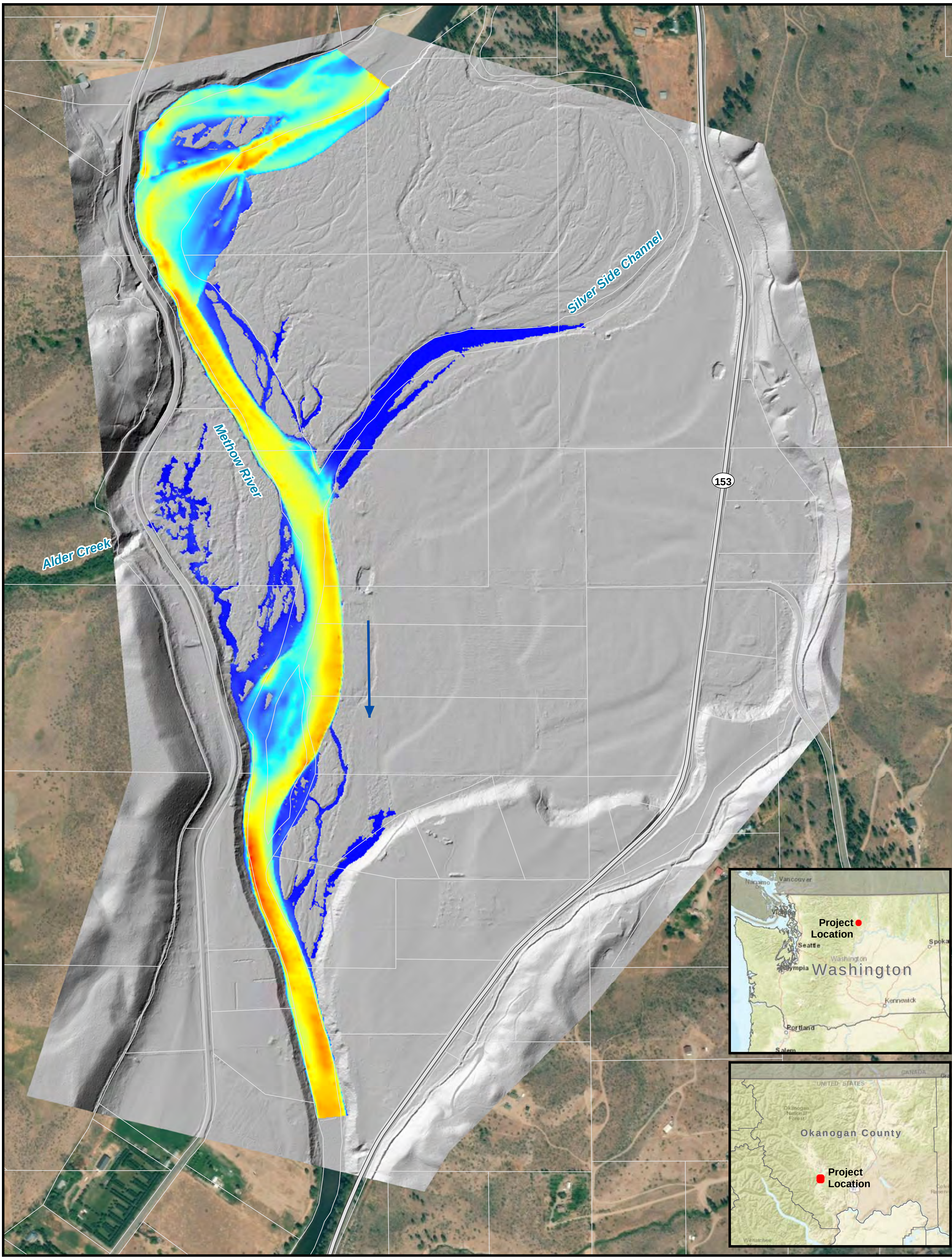
N

0 200 400
Feet

Figure 9
2-year Flow
Proposed Conditions
Hydraulic Model Inundation

Methow River = 12,276 cfs

TETRA TECH



Legend

Flow Direction

Parcel Boundary

Velocity (ft/s)

High : 13.6

Low : 0

Methow River
Alder Creek Reach
Okanogan County, Washington

N

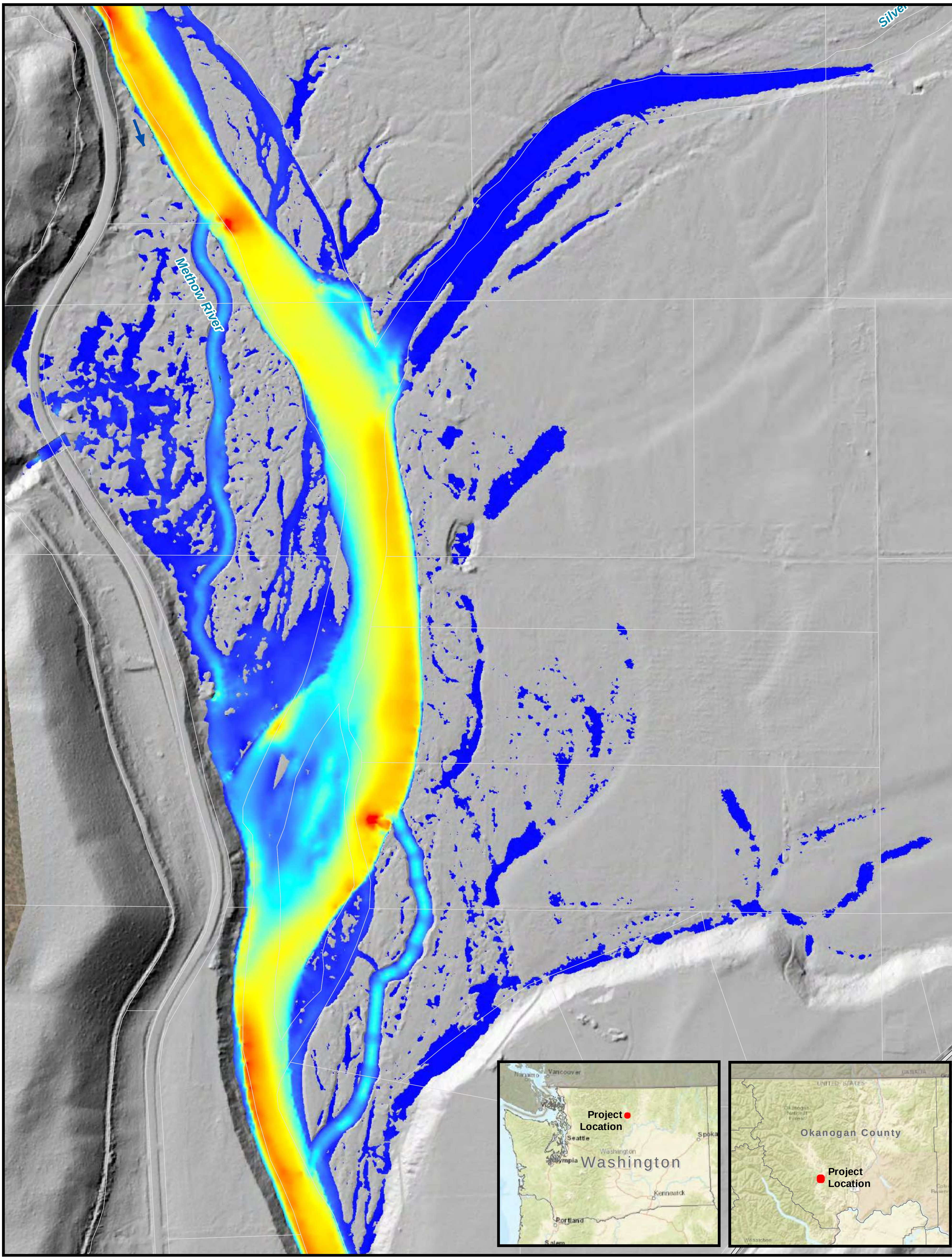
0 1,000 2,000

Feet

Figure 4
2-year Flow
Existing Conditions
Hydraulic Model Velocity

Methow River = 12,276 cfs

TETRA TECH



Legend

Flow Direction

Parcel Boundary

Velocity (ft/s)

High : 15.5

Low : 0

Methow River
Alder Creek Floodplain Project
Okanogan County, Washington

N

0 200 400
Feet

Figure 10
2-year Flow
Proposed Conditions
Hydraulic Model Velocity

Methow River = 12,276 cfs

TETRA TECH

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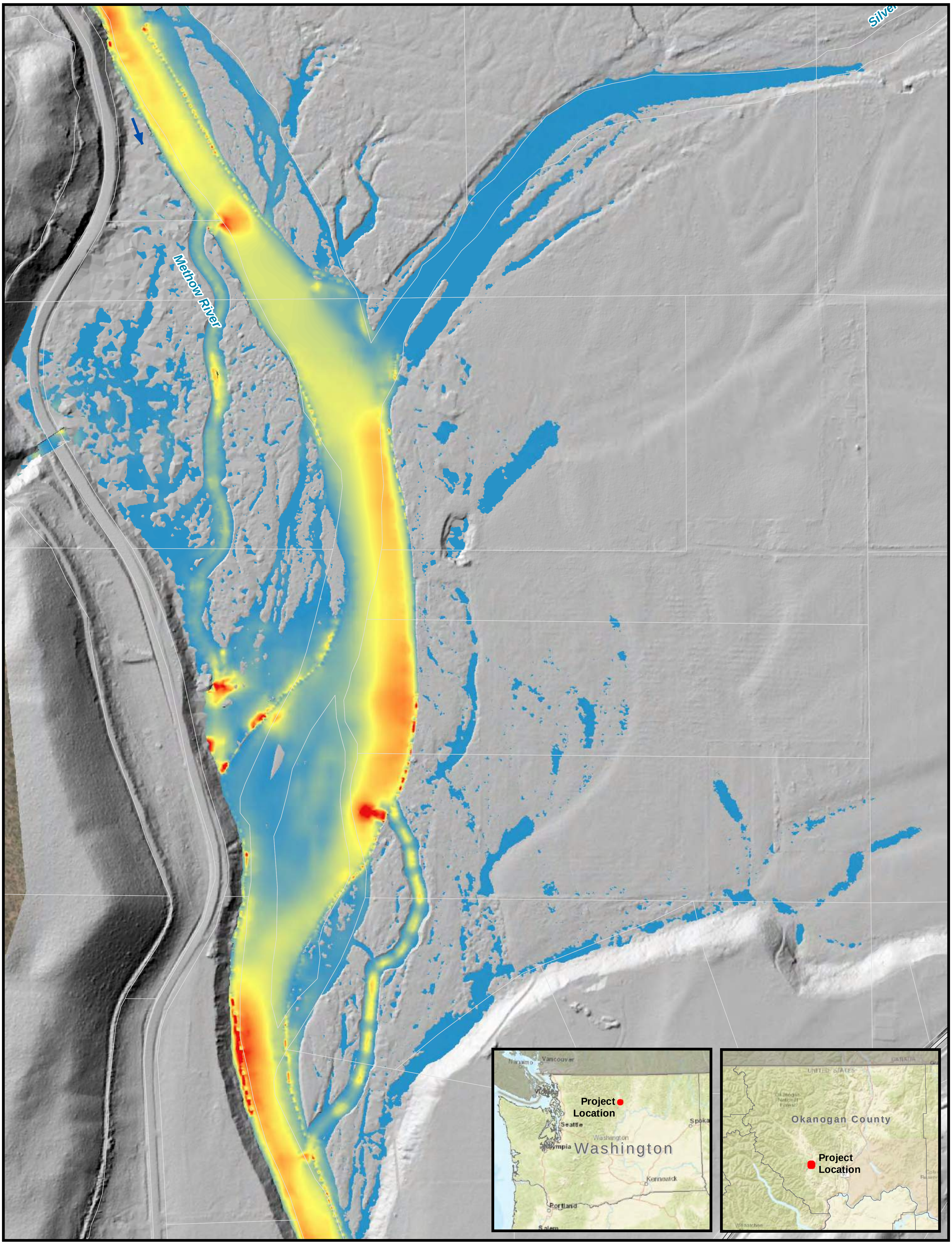


Legend
Flow Direction
Parcel Boundary
Shear Stress (psf)
High : 5.1
Low : 0

Methow River
Alder Creek Floodplain Project
Okanogan County, Washington

N

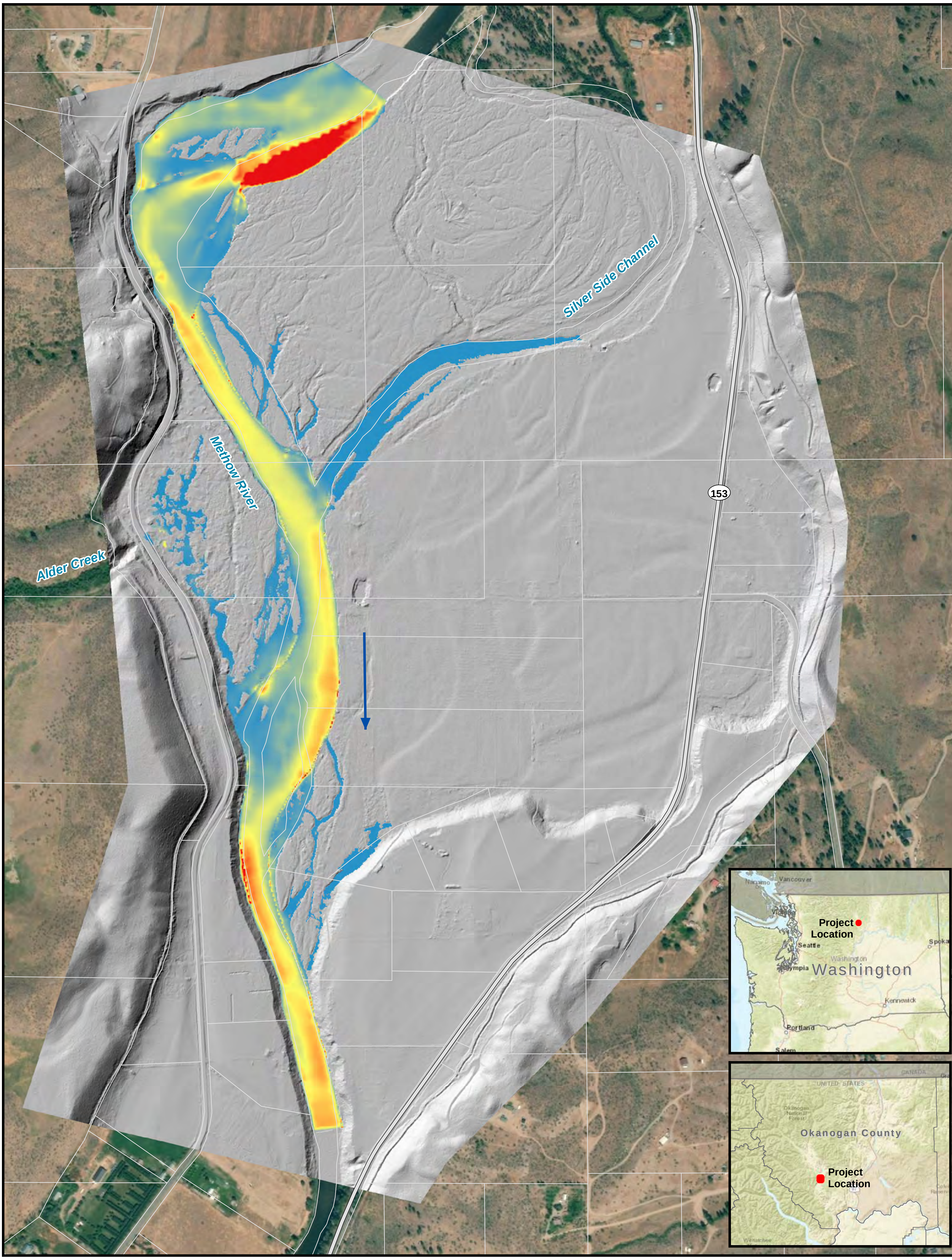
0 200 400
Feet

Figure 11
2-year Flow
Proposed Conditions
Hydraulic Model Shear Stress

Methow River = 12,276 cfs

TETRA TECH

R:\PROJECTS\TWISP_CARLTON_6189\ALDER_CREEK\MAPS\Alder_Creek_Floodplain\11_AlderCreek_Floodplain_Proposed_2yr_ShearStress.mxd



Legend

Flow Direction

Parcel Boundary

Shear Stress (psf)

High : 5.2

Low : 0

Methow River
Alder Creek Reach
Okanogan County, Washington

N

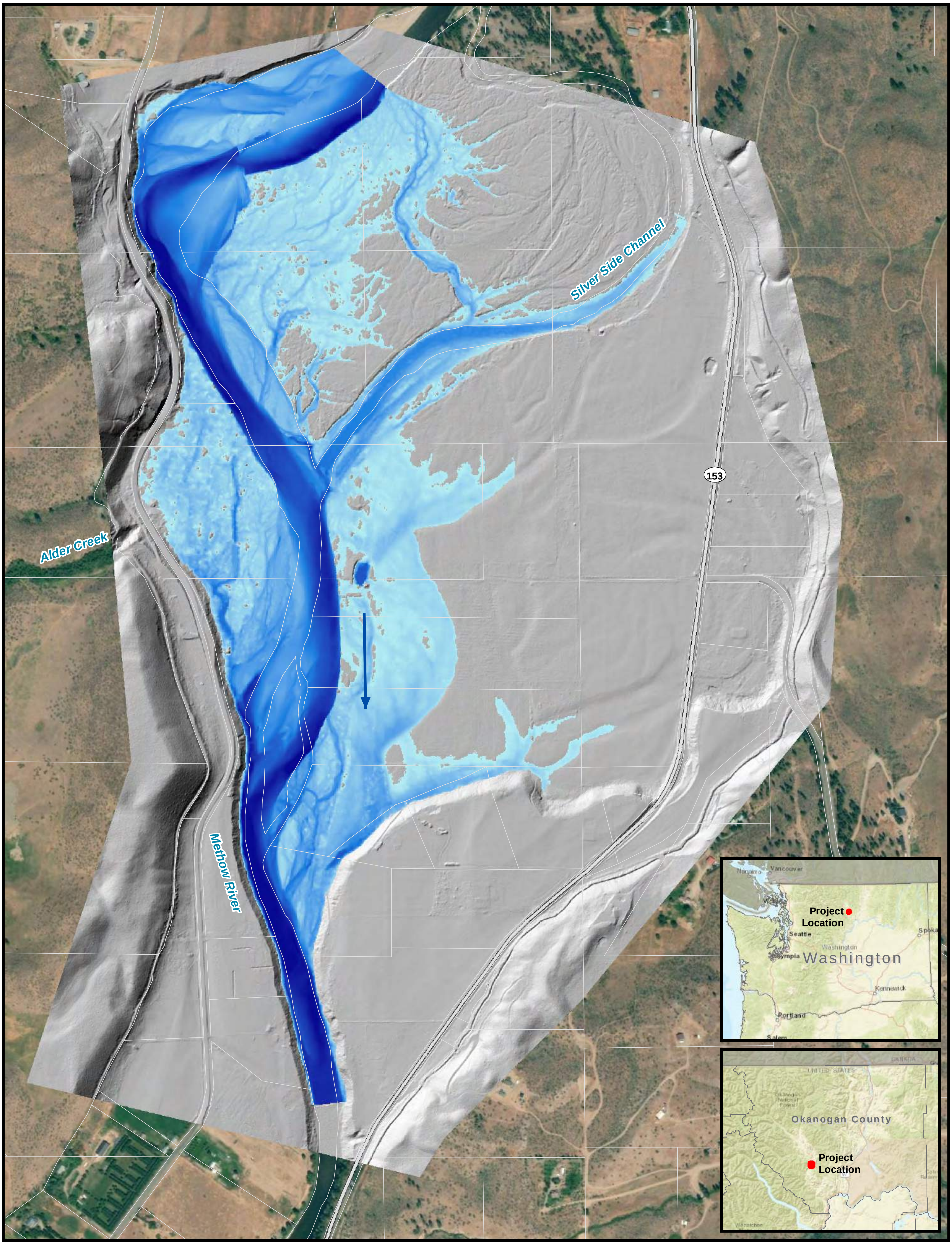
0 1,000 2,000
Feet

Figure 5
2-year Flow
Existing Conditions
Hydraulic Model
Shear Stress

Methow River = 12,276 cfs

TETRA TECH

R:\PROJECTS\TWISP_CARLTON_6189\ALDER_CREEK\MAPS\v10_3\5_AlderCreek_2yr_ShearStress.mxd



Legend

Flow Direction

Parcel Boundary

Inundation Depth (ft)

High : 17.8

Low : 0

Methow River
Alder Creek Reach
Okanogan County, Washington

N

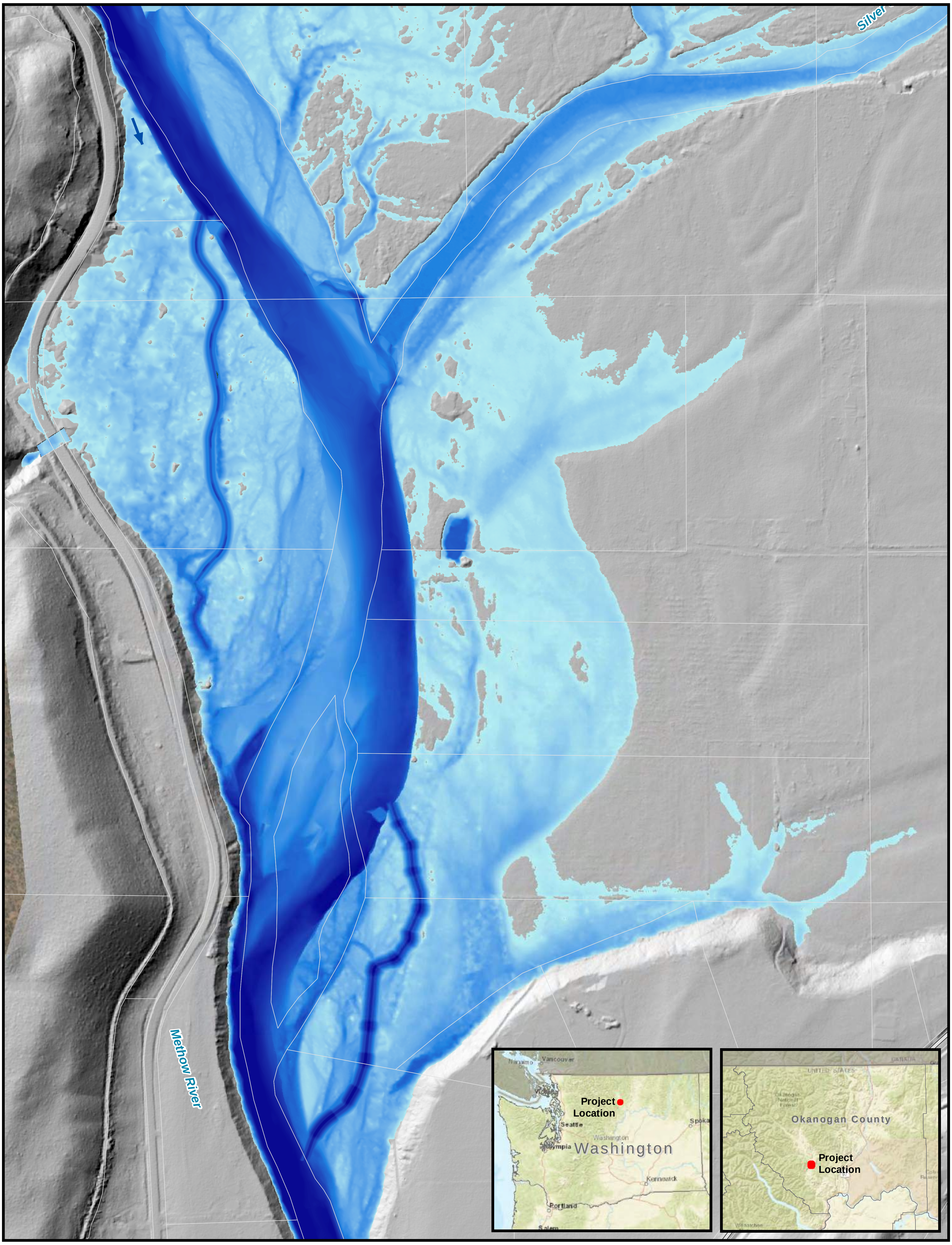
0 1,000 2,000
Feet

Figure 6
100-year Flow
Existing Conditions
Hydraulic Model Inundation

Methow River = 31,328 cfs

TETRA TECH

R:\PROJECTS\TWISP_CARLTON_6189\ALDER_CREEK\MAPS\v10_3\6_AlderCreek_100yr_Inundation1.mxd



Legend

Flow Direction

Parcel Boundary

Inundation Depth (ft)

High : 17.9

Low : 0

Methow River
Alder Creek Floodplain Project
Okanogan County, Washington

N

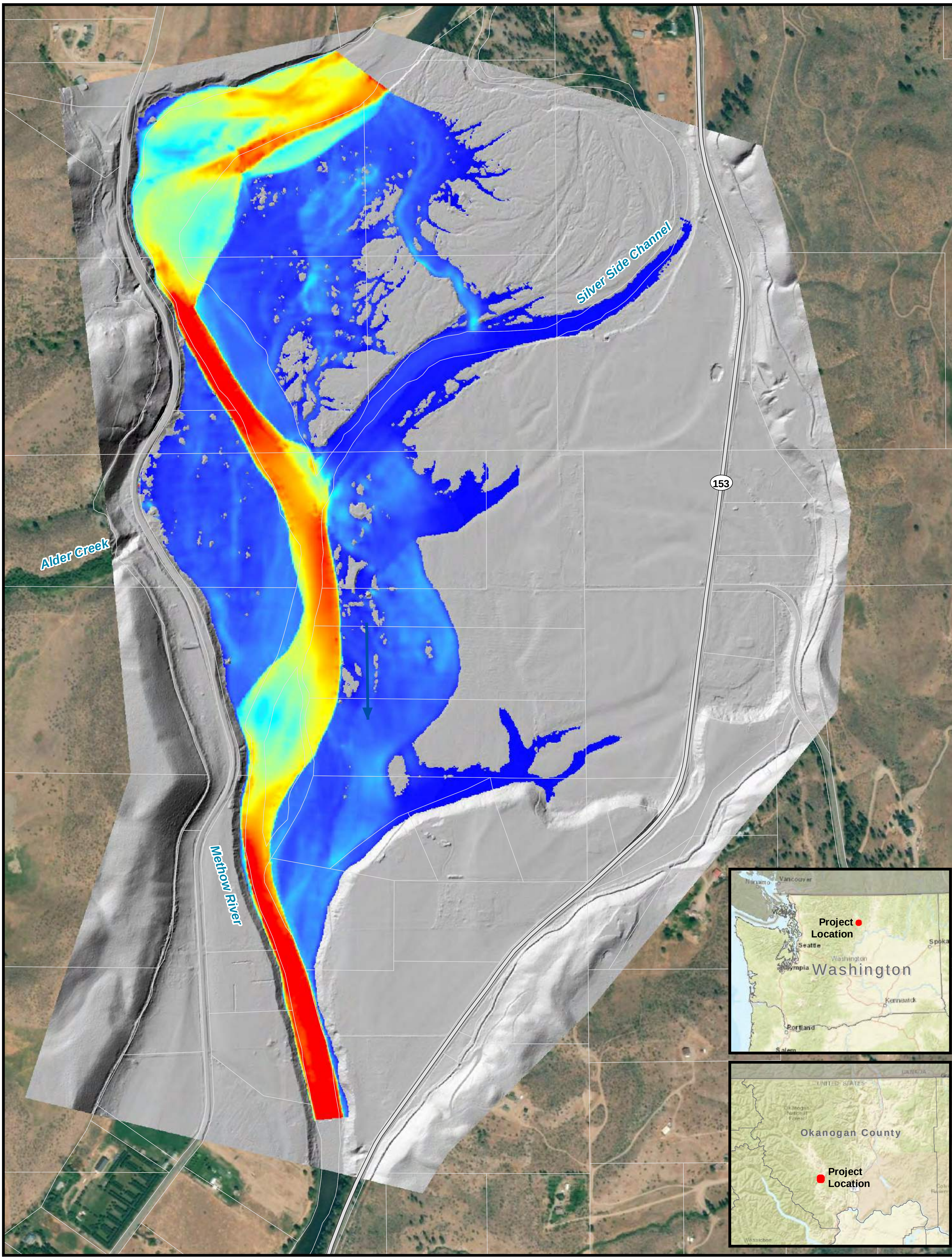
0 200 400
Feet

Figure 12
100-year Flow
Proposed Conditions
Hydraulic Model Inundation

Methow River = 31,328 cfs

TETRA TECH

R:\PROJECTS\TWISP_CARLTON_6189\ALDER_CREEK\MAPS\Alder_Creek_Floodplain\12_AlderCreek_Floodplain_Proposed_100yr_Inundation.mxd



Legend

Flow Direction

Parcel Boundary

Velocity (ft/s)

High : 22.7

Low : 0

Methow River
Alder Creek Reach
Okanogan County, Washington

N

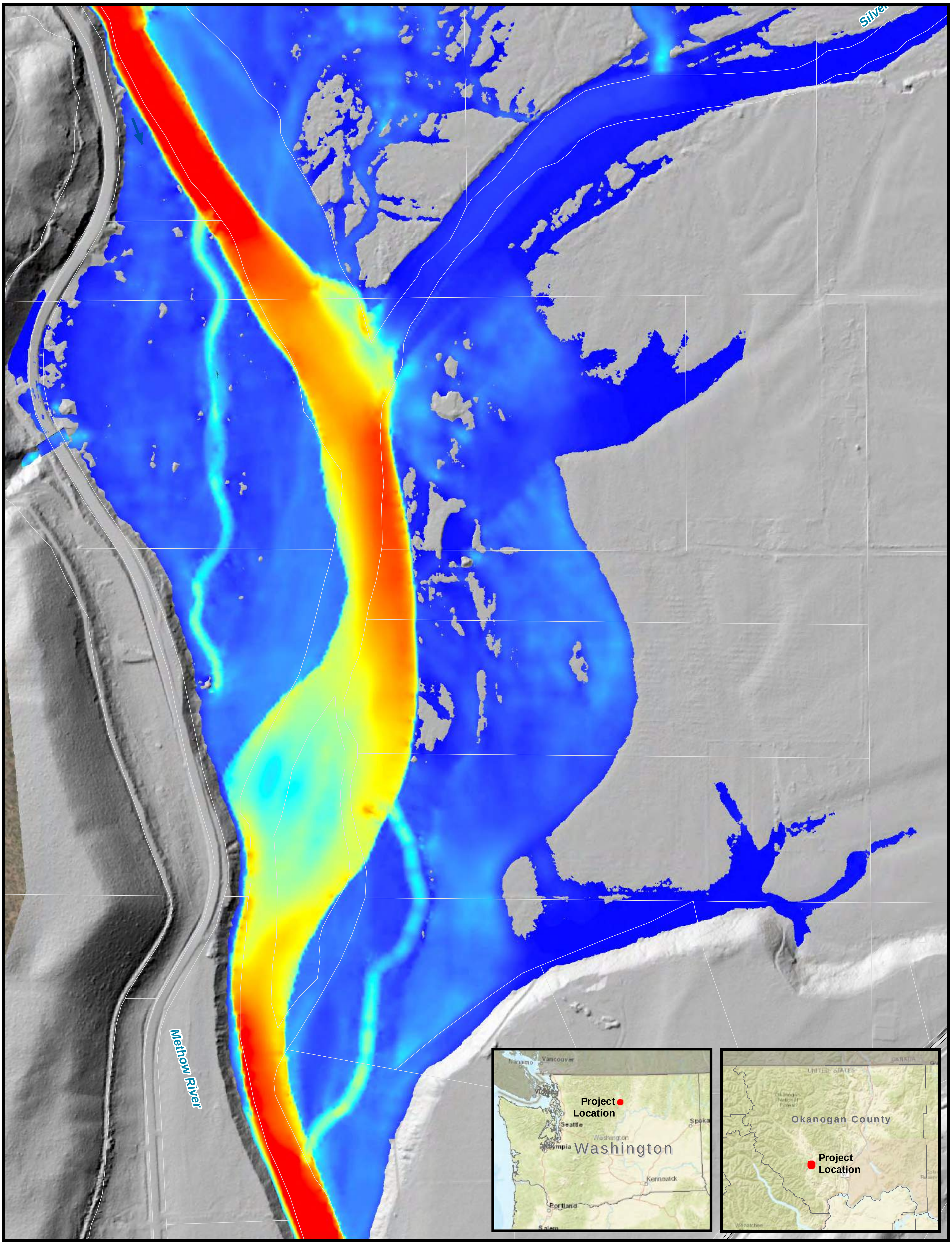
0 1,000 2,000
Feet

Figure 7
100-year Flow
Existing Conditions
Hydraulic Model Velocity

Methow River = 31,328 cfs

TETRA TECH

R:\PROJECTS\TWISP_CARLTON_6189\ALDER_CREEK\MAPS\v10_3\7_AlderCreek_100yr_Velocity.mxd



Legend

Flow Direction

Parcel Boundary

Velocity (ft/s)

High : 18.4

Low : 0

Methow River
Alder Creek Floodplain Project
Okanogan County, Washington

N

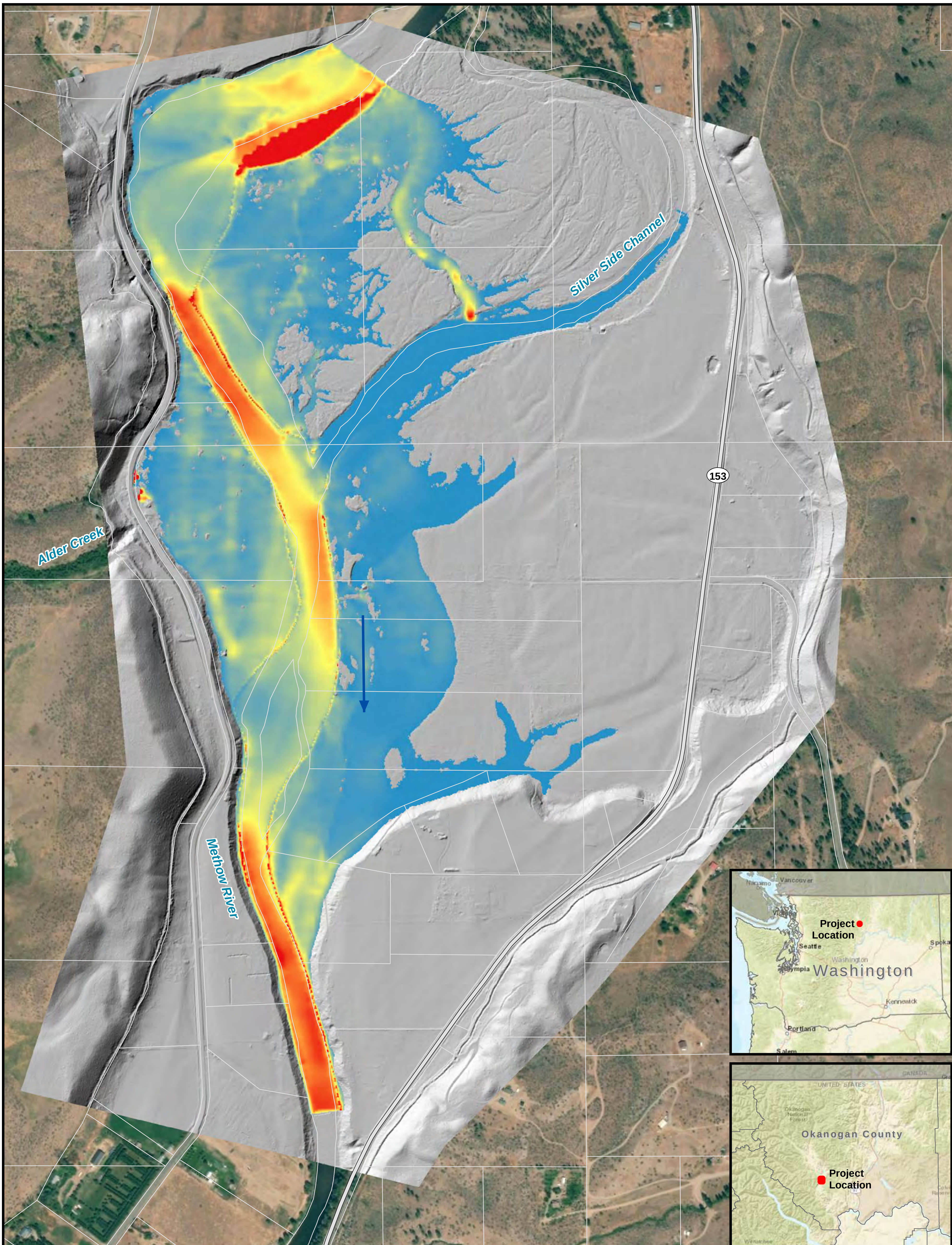
0 200 400
Feet

Figure 13
100-year Flow
Proposed Conditions
Hydraulic Model Velocity

Methow River = 31,328 cfs

TETRA TECH

R:\PROJECTS\TWISP_CARLTON_6189\ALDER_CREEK\MAPS\Alder_Creek_Floodplain\13_AlderCreek_Floodplain_Proposed_100yr_Velocity.mxd



Legend

Flow Direction

Parcel Boundary

Shear Stress (psf)

High : 6.2

Low : 0

Methow River
Alder Creek Reach
Okanogan County, Washington

N

0 1,000 2,000

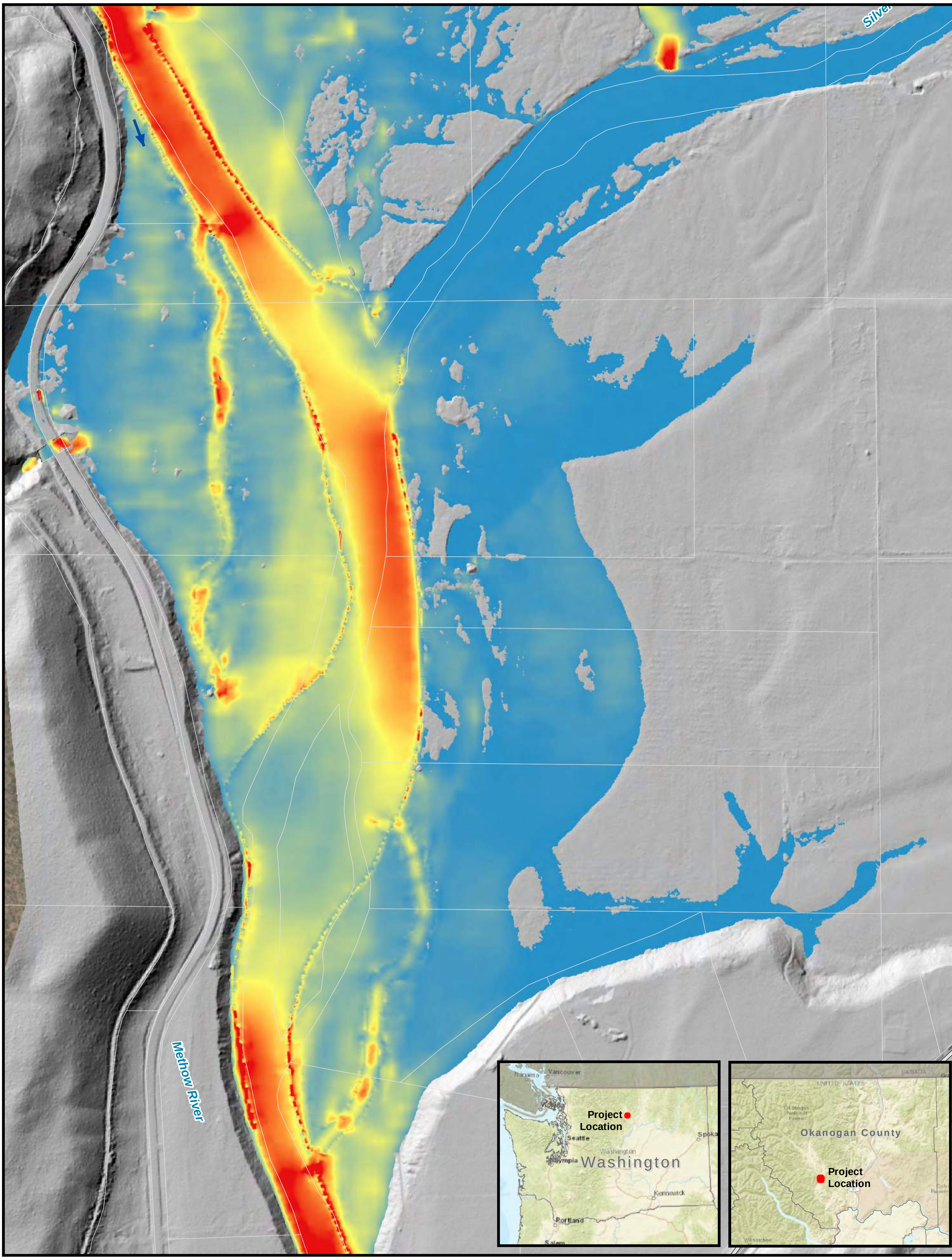
Feet

Figure 8
100-year Flow
Existing Conditions
Hydraulic Model
Shear Stress

Methow River = 31,328 cfs

TETRA TECH

R:\PROJECTS\TWISP_CARLTON_6189\ALDER_CREEK\MAPS\v10_3\8_AlderCreek_100yr_ShearStress.mxd



Legend

Flow Direction

Parcel Boundary

Shear Stress (psf)

High : 8.9

Low : 0

Methow River
Alder Creek Floodplain Project
Okanogan County, Washington

N

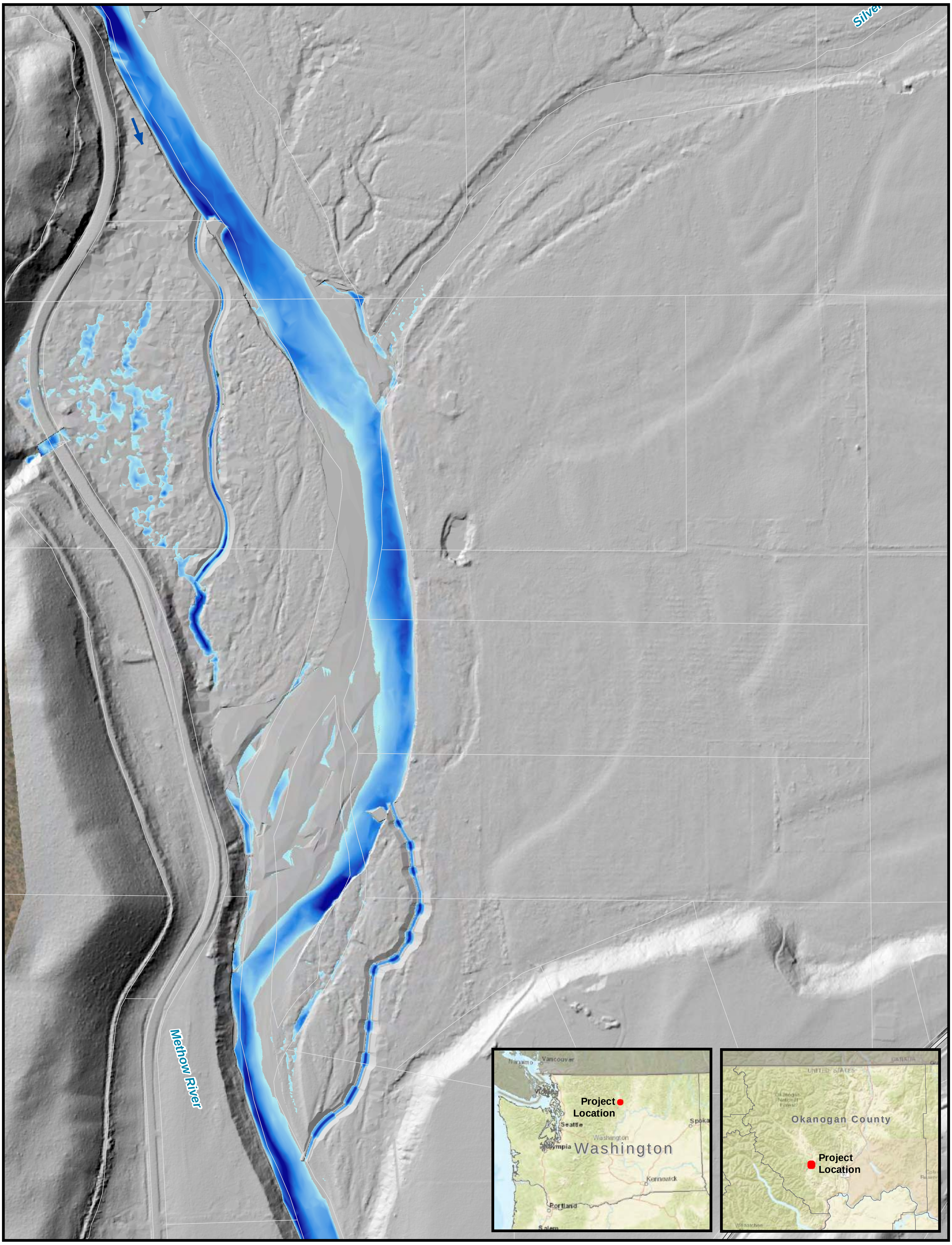
0 200 400
Feet

Figure 14
100-year Flow
Proposed Conditions
Hydraulic Model
Shear Stress

Methow River = 31,328 cfs

TETRA TECH

R:\PROJECTS\TWISP_CARLTON_6189\ALDER_CREEK\MAPS\Alder_Creek_Floodplain\14_AlderCreek_Floodplain_Proposed_100yr_ShearStress.mxd



Legend

Flow Direction

Parcel Boundary

Depth (ft)

High : 5.6

Low : 0

Methow River
Alder Creek Floodplain Project
Okanogan County, Washington

N

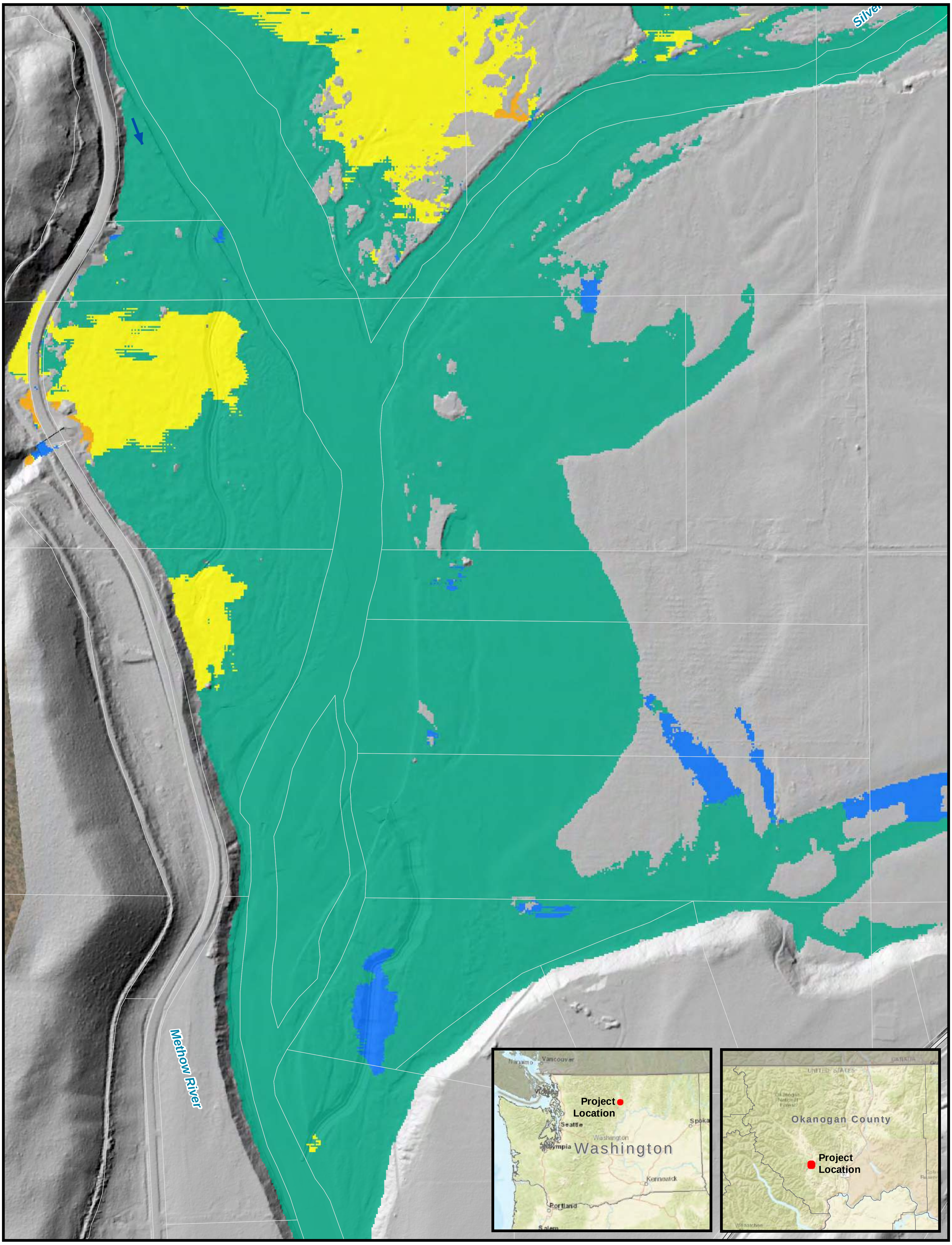
0 200 400
Feet

Figure 15
Survey Flows
Proposed Conditions
Hydraulic Model Inundation

Methow River =397 cfs

TETRA TECH

R:\PROJECTS\TWISP_CARLTON_6189\ALDER_CREEK\MAPS\Alder_Creek_Floodplain\15_AlderCreek_Floodplain_Proposed_lowflow.mxd



Legend

Flow Direction

Parcel Boundary

Elevation Difference (ft)
(Proposed Minus Existing)

-0.5 - -0.25

-0.25 - 0

0 - 0.25

0.25 - 0.5

Methow River
Alder Creek Floodplain Project
Okanogan County, Washington

N

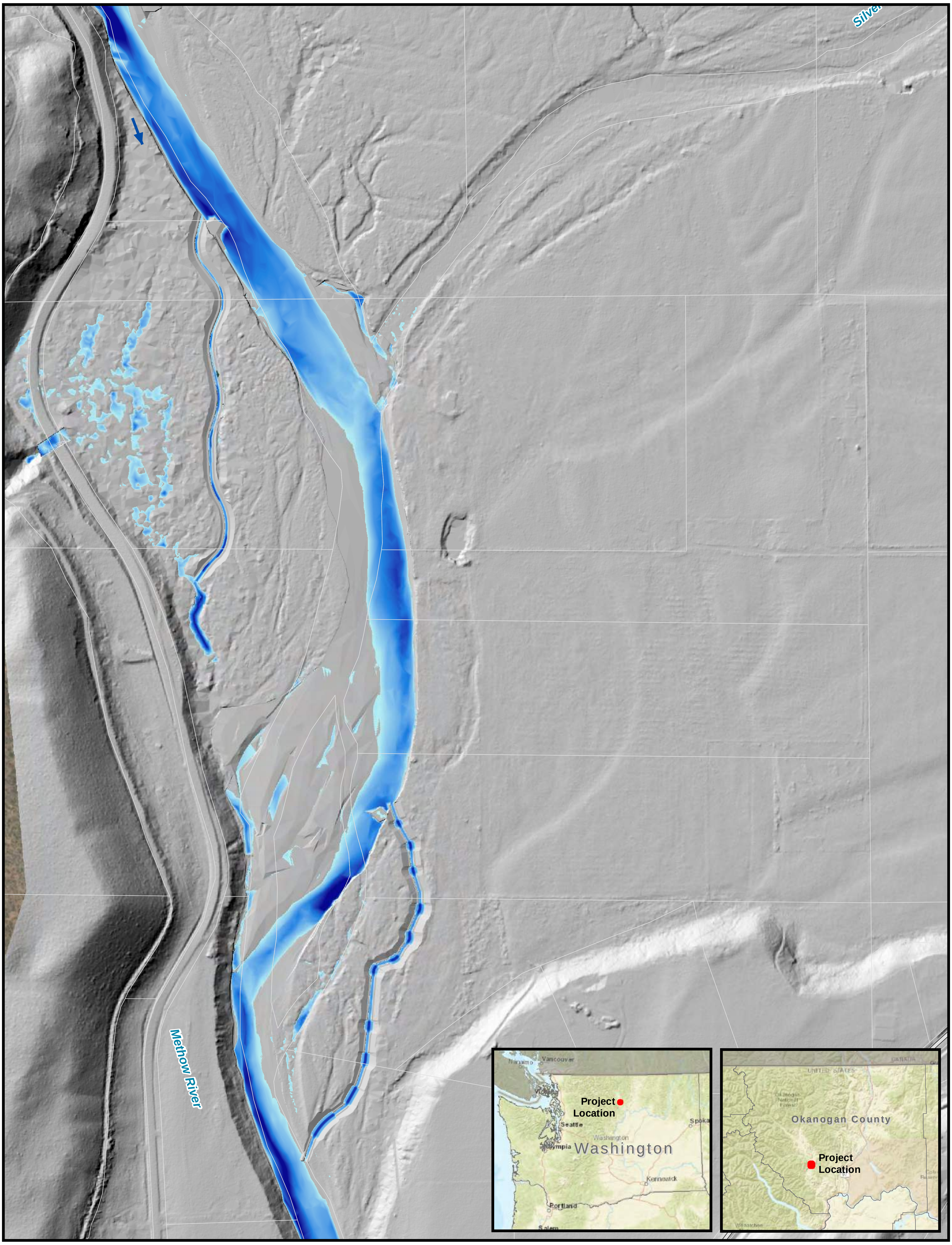
0 200 400
Feet

Figure 16
FEMA Flow
Elevation Difference
Existing vs Proposed

Methow River =35,000 cfs

TETRA TECH

R:\PROJECTS\TWISP_CARLTON_6189\ALDER_CREEK\MAPS\Alder_Creek_Floodplain\16_AlderCreek_Floodplain_DifferenceGrid.mxd



Legend

Flow Direction

Parcel Boundary

High : 5.5

Low : 0

Methow River
Alder Creek Floodplain Project
Okanogan County, Washington

N

0 200 400
Feet

Figure 17
2040 September Flows
Proposed Conditions
Hydraulic Model Inundation

Methow River =372 cfs

TETRA TECH

R:\PROJECTS\TWISP_CARLTON_6189\ALDER_CREEK\MAPS\Alder_Creek_Floodplain\17_AlderCreek_Floodplain_2040_lowflow.mxd